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Department Of School Education

Untouchability is Inhuman and a Crime

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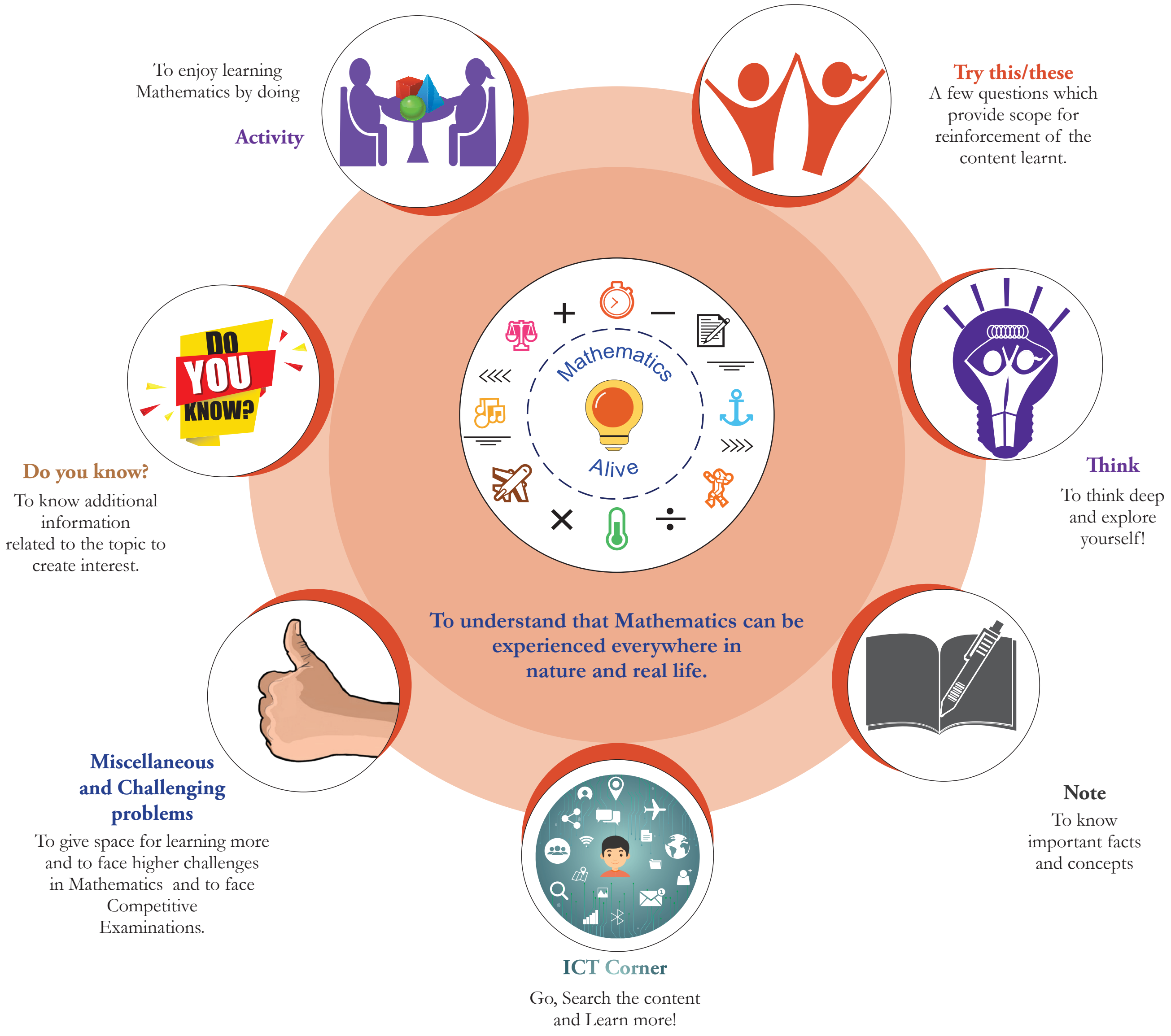
Mathematics is a unique symbolic language in which the whole world works and acts accordingly. This text book is an attempt to make learning of Mathematics easy for the students community.

Mathematics is not about numbers, equations, computations or algorithms; it is about understanding

— William Paul Thurston



The main goal of Mathematics in School Education is to mathematise the child's thought process. It will be useful to know how to mathematise than to know a lot of Mathematics.

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Evaluation

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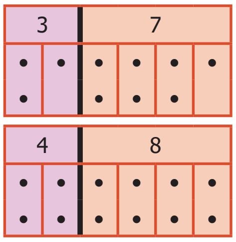
CHAPTER 1
NUMBERS

Learning Objectives:

- To identify prime and composite numbers.
- To know the divisibility rules and use them to find the factors of a number.
- To write a composite number as a product of prime numbers.
- To find the HCF and the LCM of two or more numbers and use them in real life situations.

Recap

1. Odd and Even Numbers



- A number is called an ***odd number*** if it cannot be grouped equally in twos. 1, 3, 5, 7, ..., 73, 75, ..., 2009,... are ***odd numbers.***
- A number is called an ***even number*** if it can be grouped equally in twos. 2, 4, 6, 8, ..., 68, 70, . . . , 4592,... are ***even numbers.***
- All odd numbers end with any one of the digits 1, 3, 5, 7 or 9.
- All even numbers end with any one of the digits 0, 2, 4, 6 or 8.
- In whole numbers, odd and even numbers come alternatively.

Try these

(i) Observe and complete: 1+3 = ? 5+11 = ? 21+47 = ? ....+....... = ? From this observation, we conclude that "the sum of any two odd numbers is always an ______________"	(ii) Observe and complete: 5 x 3 = ? 7 x 9 = ? 11 x 13 = ? ....x ..... = ? From this observation, we conclude that "the product of any two odd numbers is always an __________"

Justify the following statements with appropriate examples:

(iii) The sum of an odd and an even number is always an odd number.

(iv) The product of an odd and an even number is always an even number.

(v) The product of any three odd numbers is always an odd number.

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Note

- 1 is odd, its successor 2 is even and so its predecessor 0 is also even.
- The first natural number 1 is odd and the first whole number 0 is even.

2. Factors

Think about the situation:

The teacher gives Velavan two numbers 8 and 20 and asks him to write them as a product of two numbers. Velavan, with his mental math skills and also using the multiplication tables, quickly finds that 8 = 2 x 4; 20 = 2 x 10 and 4 x 5. From this, we can say that 2 and 4 are factors of 8 and also 2, 4, 5 and 10 are factors of 20. We can also write 8 as 1 x 8 and hence conclude that 1 and 8 are also factors of 8.

From the above examples, we observe that,

- **A factor is a number that divides the given number exactly (gives remainder zero)**.
- **Every number has two factors that is 1 and the number itself.**
- **Every factor of a given number is less than or equal to that number.**

3. Multiples

Look at the multiplication table of (say) 7:

1 x 7 = **7**

2 x 7 = **14**

3 x 7 = **21**

4 x 7 = **28**

5 x 7 = **35** ...

We say that the numbers 7, 14, 21, 28, 35,... are multiples of 7.

From this, we observe that

- **Every multiple of a given number is greater than or equal to that number.**

  Multiples of 7 are 7, 14, 21, 28,... . They are greater than or equal to 7.

- **Multiples of a number are endless.**

  Multiples of 5 are 5, 10, 15, 20,... . They are endless.

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Try these

(i) Say True or False.

a) The smallest odd natural number is 1.

b) 2 is the smallest even whole number.

c) 12345 + 5063 is an odd number.

d) Every number is a factor of itself.

e) A number which is a multiple of 6 is also a multiple of 2 and 3.

(ii) Is 7, a factor of 27?

(iii) Is 12, a factor or a multiple of 12?

(iv) Is 30, a factor or a multiple of 10?

(v) Which of the following numbers has 3 as a factor?

a) 8 b) 10 c) 12 d) 14

(vi) The factors of 24 are 1, 2, 3, ◇, 6, ◇, 12, and 24. Find the missing ones.

(vii) Look at the following numbers carefully and find the missing multiples.

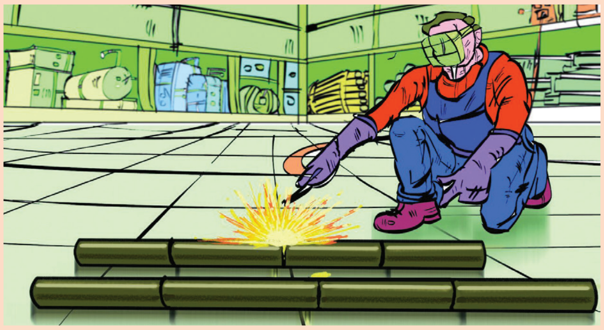
9	4		8	27			16	45			24

1.1 Introduction

In the first term, we have learnt about the natural numbers and the whole numbers. Now, we are going to learn about special numbers namely Prime and Composite, the rules for test of divisibility of numbers and also about the HCF and the LCM of numbers.

MATHEMATICS ALIVE – NUMBERS IN REAL LIFE

Use of prime numbers as a protecting key for the database of an organisation (large composite numbers are formed as a product of two large prime numbers)



HCF in day-to-day life

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1.2 Prime and Composite Numbers

Think about the situation:

The teacher gave 5 buttons to Anbuselvan and 6 buttons to Kayalvizhi and asked them to arrange the buttons in all possible rows in such a way that the number of buttons in each row is equal. They did it, in different ways as shown below:

Anbuselvan's Ways	
By arranging 5 buttons in a row, he gets 1 row 1x5=5	By arranging 1 button in each row, he gets 5 rows 5 x1=5
He realises that 5 buttons can be arranged in only 2 rectangular ways. Hence, the only factors of 5 are 1 and 5 (number of rows).	

Kayalvizhi's Ways			
By arranging 6 buttons in a row, she gets 1 row 1x6=6	By arranging 3 buttons in each row, she gets 2 rows 2x3=6	By arranging 2 buttons in each row, she gets 3 rows 3x2 = 6	By arranging 1 button in each row, she gets 6 rows 6 x 1 = 6
She realises that 6 buttons can be arranged in 4 rectangular ways. Hence, the factors of 6 are 1, 2, 3 and 6 (number of rows).			

- Make different rectangular arrangements using 1 button, 2 buttons, 3 buttons, 4 buttons,…, 10 buttons and complete the following table:

Number	Rectangular arrangements possible	Factors	Number of Factors
1		1	
2	1 x 2; 2 x 1	1, 2	2
3			
……			
10	1x 10; 10 x 1; 2x 5; 5 x 2		

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From the table, we conclude that

- **A natural number greater than 1, having only two factors namely 1 and the number itself, is called a *prime number.***

  For example, 2 (1 x 2) is a prime number as is 13 (1 x 13).

Note

The number '1' is neither prime nor composite

- **A natural number having more than 2 factors is called a *composite number.***

  For example, 15 is a composite number (15 = 1 x 3 x 5) as is 70 (70 = 1 x 2 x 5 x 7).

DO YOU KNOW?

A number is a ***perfect number*** if the sum of its factors other than the given number gives the same number. For example, ***6 is a perfect number***, since adding the factors of 6 (other than 6), namely 1, 2 and 3 gives the given number 6. i.e.,1+2+3 = 6 is the given number.

Check whether 28, 54 and 496 are perfect numbers or not.

Activity

(i) List out the prime and composite numbers represented by the dates in the month of October.

(ii) Generate a few composite numbers by product of two or more natural numbers.

(iii) Classify the numbers 34, 57, 71, 93, 101, 111 and 291 as prime or composite.

October 2018

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

1.2.1 Finding the Prime Numbers by Sieve of Eratosthenes Method

Sieve of Eratosthenes, is a simple method of elimination by which we can easily find the prime numbers upto a given number. This method given by a Greek Mathematician, Eratosthenes of Alexandria, follows some simple steps which are listed below, by which we can find the prime numbers.

Step 1: Create 10 rows and 10 columns and write the numbers from 1 to 10 in the first row, 11 to 20 in the second row and continue the same as 91 to 100 in the tenth row.

Step 2: Leave **1** as it is neither prime nor composite (Why?). Start with the smallest prime 2. Encircle and colour 2 and cross out all other multiples of 2 (all even numbers) in the grid.

Step 3: Now, take the next prime 3. Encircle and colour 3 and cross out all other multiples of 3 in the grid.

Step 4: As 4 is crossed out already, go for the next prime 5 and cross out multiples of 5, except 5.

Step 5: Keep doing this, for two more primes 7 and 11 and stop. (Think why?)

The above steps are carried out to find prime numbers upto 100 in the following grid.

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SIEVE OF ERATOSTHENES

1	2	3	~~4~~	5	~~6~~	7	~~8~~	~~9~~	~~10~~
11	~~12~~	13	~~14~~	~~15~~	~~16~~	17	~~18~~	19	~~20~~
~~21~~	~~22~~	23	~~24~~	~~25~~	~~26~~	~~27~~	~~28~~	29	~~30~~
31	~~32~~	~~33~~	~~34~~	~~35~~	~~36~~	37	~~38~~	~~39~~	~~40~~
41	~~42~~	43	~~44~~	~~45~~	~~46~~	47	~~48~~	~~49~~	~~50~~
~~51~~	~~52~~	53	~~54~~	~~55~~	~~56~~	~~57~~	~~58~~	59	~~60~~
61	~~62~~	~~63~~	~~64~~	~~65~~	~~66~~	67	~~68~~	~~69~~	~~70~~
71	~~72~~	73	~~74~~	~~75~~	~~76~~	~~77~~	~~78~~	79	~~80~~
~~81~~	~~82~~	83	~~84~~	~~85~~	~~86~~	~~87~~	~~88~~	89	~~90~~
~~91~~	~~92~~	~~93~~	~~94~~	~~95~~	~~96~~	97	~~98~~	~~99~~	~~100~~

From the Sieve of Eratosthenes, we observe that,

- The crossed-out numbers are ***composite*** and the ***coloured numbers*** (encircled) are ***primes.*** The total number of primes upto 100 is 25.
- The only prime number that ends with 5 is 5.

1.2.2 Expressing a Number as the Sum of Prime Numbers

Any number greater than 3 can always be expressed as the sum of two or more prime numbers. Let us illustrate this in the following examples.

Example 1: Express 42 and 100 as the sum of two consecutive primes.

Solution: 42 = 19+23;

100 = 47+53

Example 2: Express 31 and 55 as the sum of any three odd primes.

Solution: 31 = 5+7+19 Another way: 31 = 3+11+17

55 = 3+23+29 (find another way, if possible!)

Try these

(i) Express 68 and 128 as the sum of two consecutive primes.

(ii) Express 79 and 104 as the sum of any three primes.

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1.2.3 Twin Primes

A pair of prime numbers whose difference is 2, is called *twin primes*.

For example, (5, 7) is a twin prime pair as is (17,19).

Try to find a few more *twin prime pairs!*

DO YOU KNOW?

If three successive prime numbers differ by 2, then the prime numbers form a prime triplet. The only prime triplet is (3, 5, 7).

1.3 Rules for Test of Divisibility of Numbers

Suppose that, you are asked to simplify a fraction say $\frac{126}{216}$. Since the numbers are relatively bigger, the task is not easy. Observe that, these numbers are not only divisible by 2 and 9 exactly but by other numbers too! How do we know that 2 and 9 are factors of 126 and 216? We are going to see ***divisibility tests*** in this section which are rules, that will improve your mental math skills for such determinations.

Divisibility tests, in common, are useful in the prime factorisation of a number. Also, it is fun to find whether any large number is exactly divisible by 2, 3, 4, 5, 6, 7, 8, 9, 10 or 11 (and more...) by simply observing, examining and performing basic operations with the digits of the given number and not by doing the actual division! Curious to know? Then, remember the following interesting rules and have fun...! As divisibility by 2, 3 and 5 gain importance in the prime factorisation of a number, we will define the rules for them first!

Divisibility by 2

A number is divisible by 2, if its ones place is any one of the numbers 0, 2, 4, 6 or 8.

Examples:

1. 456368 is divisible by 2, since its ones place is 8.
2. 1234567 is not divisible by 2, since its ones place (7) is not even.

Divisibility by 3

Divisibility of a number by 3 is interesting! We can find that 96 is divisible by 3. Here, note that the sum of its digits 9+6 = 15 is also divisible by 3. Even 1+5 = 6 is also divisible by 3. This is called as *iterative* or *repeated* addition. So,

A number is divisible by 3 if the sum of its digits is divisible by 3.

Examples:

1. 654321 is divisible by 3.

   Here 6+5+4+3+2+1= 21 and 2+1=3 is divisible by 3.

   Hence, 654321 is divisible by 3.

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2. The sum of any three consecutive numbers is divisible by 3.
   (For example: 33+34+35=102, is divisible by 3)

3. 107 is not divisible by 3 since 1+0+7=8, is not divisible by 3.

Divisibility by 5

Observe the multiples of 5. They are 5, 10, 15, 20, 25,.., 95, 100, 105, …., and keeps on going. It is clear, that multiples of 5 end either with 0 or 5 and so,

A number is divisible by 5 if its ones place is either 0 or 5.

Examples: 5225 and 280 are divisible by 5

Try these

(i) Are the leap years divisible by 2?
(ii) Is the first 4 digit number divisible by 3?
(iii) Is your date of birth (DDMMYYYY) divisible by 3?
(iv) Check whether the sum of 5 consecutive numbers is divisible by 5.
(v) Identify the numbers in the sequence 2000, 2006, 2010, 2015, 2019, 2025 that are divisible by both 2 and 5.

Divisibility by 4

A number is divisible by 4 if the last two digits of the given number is divisible by 4.
Note that **if the last two digits of a number are zeros, then also it is divisible by 4.**

Examples: 71628, 492, 2900 are divisible by 4, because 28 and 92 are divisible by 4 and 2900 is also divisible by 4 as it last 2 digits are zero.

Divisibility by 6

A number is divisible by 6 if it is divisible by both 2 and 3.

Examples: 138, 3246, 6552 and 65784 are divisible by 6.

Note

Though a rule for divisibility of a number by 7 exists, it is a bit tricky and dividing directly by 7 will be easier.

Divisibility by 8

A number is divisible by 8 if the last three digits of the given number is divisible by 8.
Note that **if the last three digits of a number are zeros, then also it is divisible by 8.**

Examples: 2992 is divisible by 8 as 992 is divisible by 8 and 3000 is divisible by 8 as its last three digits are zero.

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Divisibility by 9

A number is divisible by 9 if the sum of its digits is divisible by 9. Note that the numbers divisible by 9 are also divisible by 3.

Examples: 9567 is divisible by 9 as 9+5+6+7=27 is divisible by 9.

Divisibility by 10

A number is divisible by 10 if its ones place is only zero. Observe that numbers divisible by 10 are also divisible by 5.

Examples:

1. 2020 is divisible by 10 (2020÷10 = 202) where as 2021 is not divisible by 10.
2. 26011950 is divisible by 10 and hence divisible by 5.

Divisibility by 11

A number is divisible by 11 if the difference between the sum of alternative digits of the number is either 0 or divisible by 11.

Examples: Consider the number 256795. Here, the difference between the sum of alternative digits = (2+6+9)−(5+7+5)=17−17=0.
Hence, 256795 is divisible by 11.

Activity

The teacher may ask all the students to check mentally for divisibility by 2, 3, 4, 5, 6, 8, 9, 10 and 11. If divisible, let them write 'yes', otherwise 'no'(the first one is done for you!).

Number	÷ 2	÷ 3	÷ 4	÷ 5	÷ 6	÷8	÷9	÷10	÷11
68	yes	no	yes	no	no	no	no	no	no
99									
300									
495									
1260									
7920									
11880									
13650									
600600									
15081947									

1.4 Prime Factorisation

Expressing a given number as a product of factors that are all prime numbers is called the ***prime factorisation*** of a number. For example, 36 can be written as product of factors as

36 =1 x 36; 36 = 2 x 18; 36 = 3 x 12; 36 = 4 x 9; 36 = 6 x 6

Here, the factors of 36 can be found easily as 1, 2, 3, 4, 6, 9, 12, 18 and 36. Note that not all the factors of 36 are prime numbers. To find the prime factors of 36, we do the prime factorisation by the following methods.

1. Division Method **2. Factor Tree Method**

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1. Division Method: We can find the prime factorisation of 36 as follows:

2	36
2	18
3	9
3	3
	1

36 = 2 x 2 x 3 x 3

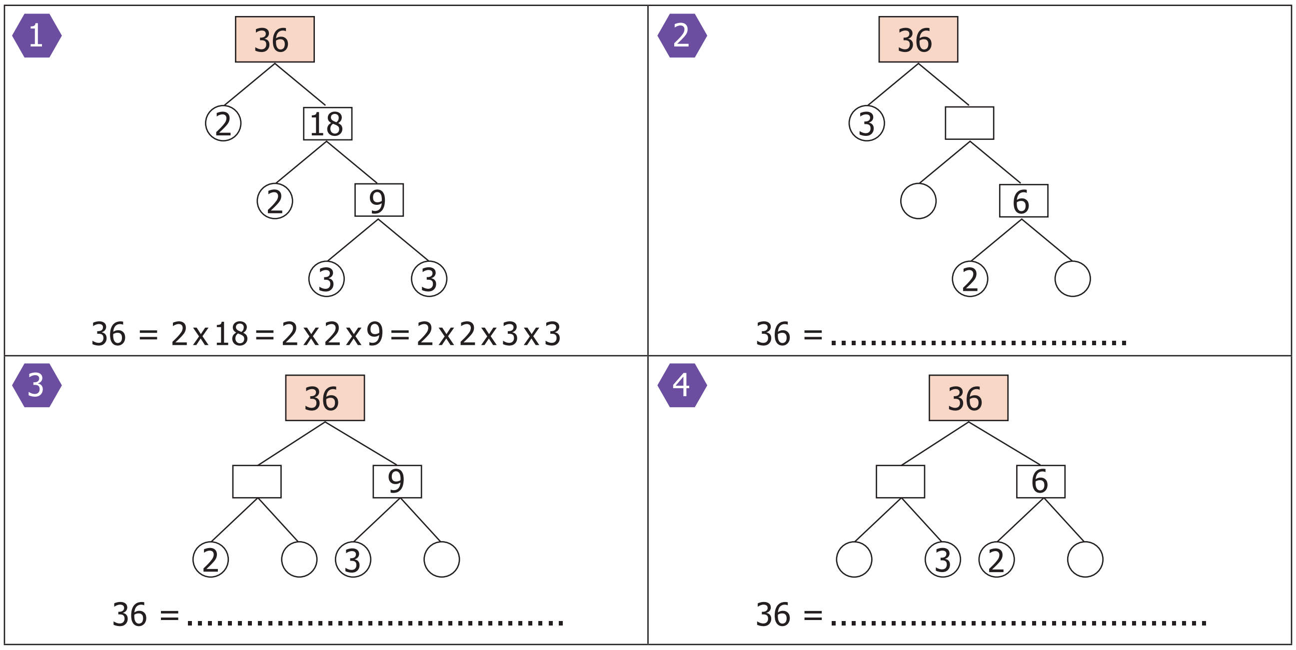
3	36
2	12
2	6
3	3
	1

36 = 3 x 2 x 2 x 3

In the above method, why do we start with 2 or 3 ? why not with 5? Because, we know that 36 is not a multiple of 5 and hence not divisible by 5. So, to find the prime factors of a number, it will be useful to check for divisibility by smaller numbers like 2, 3 and 5 first and not take numbers at random.

2. Factor Tree Method:

Another way to find the prime factorisation of a number is to use a visual representation called **factor tree**. As we add more branches, we will see that this visual representation looks like an upside down tree. Let us find the prime factorisation of 36 as shown below. (Solution for the first one is given for you! Complete the remaining).



What we observe from the above is that, the factors of 36 are the same in all the cases, though the order of the factors is different. Usually, the factors are ordered from the least to the greatest as 2x2x3x3.

Note

- Since multiplication satisfies commutativity, the order of the factors in the product does not affect the value of the number.

DO YOU KNOW?

All the prime numbers, except 2 and 3 can be expressed as 1 more or 1 less to a multiple of 6 (For example, 37= 6x6+1). Explore this statement for other primes!

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Exercise 1.1

1. Fill in the blanks

(i) The number of prime numbers between 11 and 60 is________.

(ii) The numbers 29 and________ are twin primes.

(iii) 3753 is divisible by 9 and hence divisible by _______ .

(iv) The number of distinct prime factors of the smallest 4 digit number is __________.

(v) The sum of distinct prime factors of 30 is_______.

2. Say True or False

(i) The sum of any number of odd numbers is always even.

(ii) Every natural number is either prime or composite.

(iii) If a number is divisible by 6, then it must be divisible by 3.

(iv) 16254 is divisible by each of 2, 3, 6 and 9.

(v) The number of distinct prime factors of 105 is 3.

3. Write the smallest and the biggest two digit prime number.

4. Write the smallest and the biggest three digit composite number.

5. The sum of any three odd natural numbers is odd. Justify this statement with an example.

6. The digits of the prime number 13 can be reversed to get another prime number 31. Find if any such pairs exist upto 100.

7. Your friend says that every odd number is prime. Give an example to prove him/her wrong.

8. Each of the composite numbers has atleast three factors. Justify this statement with an example.

9. Find the dates of any month in a calendar which are divisible by both 2 and 3.

10. I am a two digit prime number and the sum of my digits is 10. I am also one of the factors of 57. Who am I?

11. Do the prime factorisation of each number by factor tree method and division method.

a) 60 b) 128 c) 144 d) 198 e) 420 f) 999

12. If there are 143 math books to be arranged in equal numbers in all the stacks, then find the number of books in each stack and also the number of stacks.

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Objective Type Questions

13. The difference between two successive odd numbers is

    a) 1 b) 2 c) 3 d) 0

14. The only even prime number is

    a) 4 b) 6 c) 2 d) 0

15. Which of the following numbers is not a prime?

    a) 53 b) 92 c) 97 d) 71

16. The sum of the factors of 27 is

    a) 28 b) 37 c) 40 d) 31

17. The factors of a number are 1, 2, 4, 5, 8, 10, 16, 20, 40 and 80.What is the number?

    a) 80 b) 100 c) 128 d) 160

18. The prime factorisation of 60 is $2 \times 2 \times 3 \times 5$. Any other number which has the same prime factorisation as 60 is

    a) 30 b) 120 c) 90 d) impossible

19. If the number $6354 * 97$ is divisible by 9, then the value $*$ is

    a) 2 b) 4 c) 6 d) 7

20. The number 87846 is divisible by

    a) 2 only b) 3 only c) 11 only d) all of these

1.5 Common Factors

Consider the numbers 45 and 60. Use of divisibility tests will also help us to find the factors of 45 and 60. The factors of 45 are 1,3,5,9,15 and 45 and the factors of 60 are 1,2,3,4,5,6,10,12,15,20, 30 and 60. Here, the common factors of 45 and 60 are 1,3,5 and 15.

As factors of a number are finite, we can think of the **Highest Common Factor** of numbers, shortly denoted as **HCF**.

1.5.1 Highest Common Factor (HCF)

Think about the situation:

Situation 1:

Pavithra plans to celebrate Deepavali at her home by distributing sweets and savouries to her relatives. Pavithra's mother gives her 63 athirasams and 42 murukkus. Each relative should be given the same number of athirasams and the same number of murukkus. What is the greatest number of relatives that she can distribute?

Now, Pavithra can tackle this situation by using HCF as given in the following illustration.

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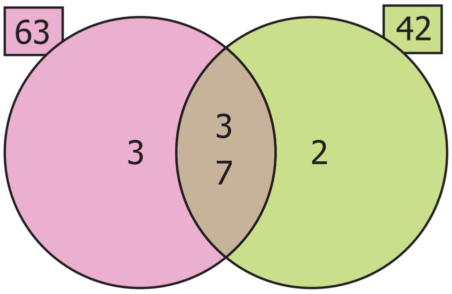
Illustration: Find the HCF of 63 and 42.

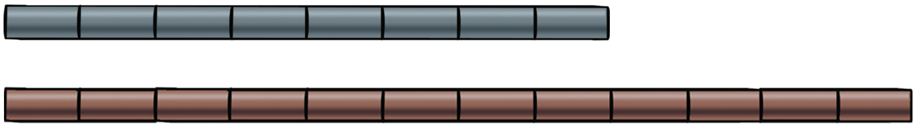
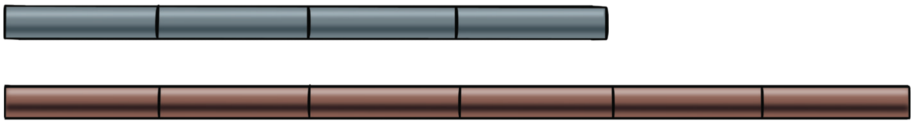
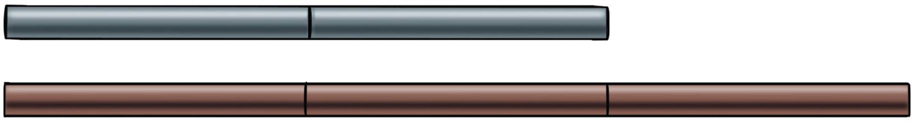


Solution: The prime factorisation of 63 is 3 x 3 x 7 and the prime factorisation of 42 is 2 x 3 x 7. We find that the common prime factors of 63 and 42 are 3 and 7 (see the diagram) and so the highest common factor is 3 x 7 =21. So, Pavithra can distribute equal number of athirasams (3 for each relative) and murukkus (2 for each relative) for a maximum of 21 relatives.

Situation 2:

Consider the rods of length 8 feet and 12 feet. We have to cut these rods into pieces of equal length. How many pieces can we get? What will be the length of the longest piece that is common for both the rods?

The rod of 8 feet can be divided into small rods of length 1 foot or 2 feet or 4 feet (These are factors of 8). The rod of 12 feet can be divided into small rods of length 1 foot or 2 feet or 3 feet or 4 feet or 6 feet (These are factors of 12). This is represented as follows:

First, it is possible to cut the 8 feet and 12 feet rods equally into 1 foot rods. 	Number of pieces 8 12
Second, it is also possible to cut the 8 feet and 12 feet rods equally into 2 feet rods. 	4 6
Third, it is also possible to cut the 8 feet and 12 feet rods equally into 4 feet rods 	2 3

The length of the pieces that are common to both the rods (as given above) are of length 1 foot, 2 feet and 4 feet (i.e., common factors of 8 and 12).

Hence, the HCF of 8 and 12 is the length of the longest rod i.e., **4 feet** that can be cut equally from the rods of length 8 feet and 12 feet.

So, the **Highest Common Factor (HCF)** of two numbers is the largest factor that is common to both of them.The Highest Common Factor of the numbers *x* and *y* can be written as HCF (*x*,*y*).

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Note

- The Highest Common Factor (HCF) is also called as the Greatest Common Divisor (GCD) or the Greatest Common Factor (GCF).
- HCF $(1, x) = 1$
- HCF $(x, y) = x$, if y is a multiple of x. For example, HCF (3, 6) = 3.
- If the HCF of two numbers is 1, then the numbers are said to be **co-primes** or **relatively prime.** Here, the two numbers can both be primes as (5, 7) or both can be composites as (14, 27) or one can be a prime and other a composite as (11, 12).

Example 3: Find the HCF of the numbers 40 and 56 by division method.

Solution:

2	40
2	20
2	10
5	5
	1

2	56
2	28
2	14
7	7
	1

or

2	40, 56
2	20, 28
2	10, 14
	5, 7

Prime factorisation of 40 = 2 x 2 x 2 x 5
Prime factorisation of 56 = 2 x 2 x 2 x 7
The product of common factors of 40 and 56
= 2 x 2 x 2 = 8 and so, HCF (40, 56) = 8

Dividing by the common factor 2,
(in 3 steps)
HCF = Product of common factors
= 2 x 2 x 2 = 8

Example 4: Find the HCF of the numbers 18, 24 and 30 by factor tree method.

Solution:

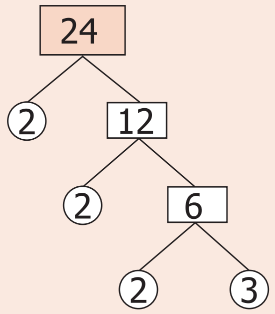
Let us find the factors of 18, 24 and 30 (use of divisibility test rules will also help).

The factors of 18 are 1, 2, 3, 6, 9 and 18.
The factors of 24 are 1, 2, 3, 4, 6, 8, 12 and 24.
The factors of 30 are 1, 2, 3, 5, 6, 10, 15 and 30.

The factors that are common to all the three given numbers are 1, 2, 3 and 6 of which 6 is the highest. Hence, HCF (18, 24, 30) = 6.

Note that 1 is a trivial factor of all numbers.

Let us find the factors of 24 by tree method.



Here, 24 = 2 x 2 x 2 x 3
Similarly, we can find the factors of 18 and 30.

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1.6 Common Multiples

Let us now write the multiples of 5 and 7

Multiples of 5 are 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70,…

Multiples of 7 are 7, 14, 21, 28, 35, 42, 49, 56, 63, 70,…

Here, the common multiples of 5 and 7 are 35 and 70 and will go on without ending.

As multiples of a number are infinite, we can think of the **Least Common Multiple** of numbers, shortly denoted as **LCM**.

1.6.1 Least Common Multiple (LCM)

Think about the situation:

Situation 1: Write the multiplication table of 4 and 5 (upto 10).

4th Table	5th Table
1x4 = 4	1x5 = 5
2x4 = 8	2x5 = 10
3x4 = 12	3x5 = 15
4x4 = 16	4x5 = **20**
5x4 = **20**	5x5 = 25
6x4 = 24	6x5 = 30
7x4 = 28	7x5 = 35
8x4 = 32	8x5 = **40**
9x4 = 36	9x5 = 45
10x4 = **40**	10x5 = 50

Observing the multiplication tables, can you find the multiples (product of numbers) that are the same in the 4th table and 5th table?. If yes, what are they? They are **20, 40,**…etc. From the multiples of 4 and 5, we can easily find that 20 is the least common multiple of 4 and 5.

Situation 2:

Anu wants to buy Ragi Laddus and Thattais to serve at her sister's birthday party. Ragi Laddus come in packets of 4 and Thattais come in packets of 6. Anu has to buy these packets so that there are the same number of Ragi Laddus and Thattais to serve at the party. How will Anu tackle this situation?

This situation can be tackled by Anu using the concept of LCM. Here, multiples of 4 are 4, 8, 12, 16, 20, 24, ... and multiples of 6 are 6, 12, 18, 24, 30, 36, ... We find that the common multiples are 12, 24, ... of which 12 is the least common multiple. Hence, Anu should buy a minimum of 3 packets of Ragi Laddus and 2 packets of Thattais so that there are the same number of Ragi Laddus (12) and Thattais (12) to serve at the party.

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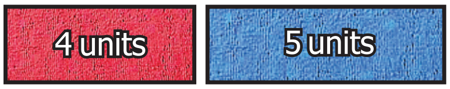
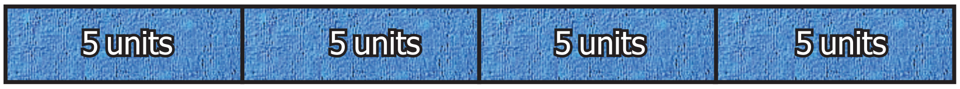
Situation 3:

Consider the red and the blue coloured floor mats of length 4 units and 5 units as follows.



Five red coloured floor mats of 4 units each can be arranged as follows. Its total length is 5 x 4 = 20 units.

Four blue coloured floor mats of 5 units each can be arranged as follows. Its total length is also the same 4 x 5 = 20 units.



Note that the 5 floor mats each of length 4 units are required to equal 4 floor mats each of length 5 units and that is, the length 20 units is the smallest common length that can be matched by both sizes. From the above, it shows that the least common multiple of 4 and 5 is 4x5=20.

The **Least Common Multiple** of any two non-zero whole numbers is the smallest or the lowest common multiple of both the numbers. The Least Common Multiple of the numbers x and y can be written as LCM (x,y).

We can find the least common multiple of two or more numbers by the following methods.

1. **Division Method**
2. **Prime Factorisation Method**

Example 5: Find the LCM of 156 and 124.

Solution: By **Division method**

2	156,124
2	78, 62
3	39, 31
13	13, 31
31	1, 31
	1,1

Step 1: Start with the smallest prime factor and go on dividing till all the numbers are divided as given below.

Step 2: LCM = product of all prime factors

= 2 x 2 x 3 x 13 x 31 = 4836

Thus, the LCM of 156 and 124 is 4836.

By **Prime Factorisation method**

Step 1: We write the prime factors of 156 and 124 as given below (use of divisibility test rules will also help).

156 = 2 x 78 = 2 x 2 x 39 = 2 x 2 x 3 x 13

124 = 2 x 62 = 2 x 2 x 31

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Step 2: The product of common factors is 2 x 2 and also the product of the factors that are not common is 3 x 13 x 31.

Step 3: Now, LCM = product of common factors x product of factors that are not common

= (2 x 2) x (3 x 13 x 31) = 4 x 1209 = 4836

Thus, LCM of 156 and 124 is 4836.

(or)

156 = 2 x 78 = 2 x 2 x 39 = 2 x 2 x 3 x 13;

124 = 2 x 62 = 2 x 2 x 31

The prime factor 2 appears a maximum of 2 times in the prime factorization of 156 and 124, the prime factor 3 appears only 1 time in the prime factorization of 156, the prime factor 13 appears only 1 time in the prime factorization of 156 and the prime factor 31 appears only 1 time in the prime factorization of 124.

Hence, the required LCM = (2 x 2) x 3 x 13 x 31 = 4836.

1.7 Application Problems on HCF and LCM

Let us see the word problems that involve the HCF and the LCM concepts in daily life situations.

Example 6: What is the greatest number that will divide 62, 78 and 109 leaving remainders 2, 3 and 4 respectively?

Solution: Get all the common factors of 62 – 2, 78 – 3 and 109 – 4, i.e., 60, 75 and 105 and see that the common factors will divide them all. The greatest number is the H.C.F of 60, 75 and 105.

60=2 x 2 x 3 x 5   75=3 x 5 x 5   105=3 x 5 x 7

Hence, the HCF is 3 x 5=15, which is the greatest number that will divide 62, 78, 109 leaving remainders 2, 3 and 4 respectively.

Example 7: A book seller has 175 English books, 245 Science books and 385 Mathematics books. He wants to sell the books in a box, subject-wise in equal numbers. What will be the greatest number of the boxes required? Also find the number of books for each subject in a box.

Solution: This is a HCF related problem. So, we need to find the HCF of 175, 245 and 385.

5	175	5	245	5	385
5	35	7	49	7	77
7	7	7	7	11	11
	1		1		1

175 = 5 x 5 x 7;   245 = 5 x 7 x 7;   385 = 5 x 7 x 11

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The HCF of 175, 245 and 385 is the product of the common factors 5 and 7 i.e, 5 x 7=35

Since each box contains equal number of books, the greatest possible number of boxes = 35

The number of English books in each box = 175÷35=5

The number of Science books in each box = 245÷35=7

The number of Maths books in each box = 385÷35=11

Hence, the total number of books in each box is 5+7+11=23.

Note

- LCM is always greater than or equal to the largest of the given numbers.
- LCM will always be a multiple of HCF. Further, LCM > HCF.
- LCM (*x*, *y*) = *y*, if *y* is a multiple of *x*. For example, LCM (3, 6) = 6.

Example 8: Find the ratio of the HCF and the LCM of the numbers 18 and 30.

Solution: Now, 18 = 2 x 3 x 3 and 30 = 2 x 3 x 5

and their HCF is 2 x 3 = 6 and LCM is 2 x 3 x 3 x 5 = 90

Hence, HCF : LCM = 6:90 = 1:15

Example 9: Find the smallest number that can be divided by 254 and 508 which leaves the remainder 4.

Solution: All common multiples of 254 and 508 will be divisible by both the numbers. Let us find the LCM of 254 and 508 (by division method).

2	254, 508
2	127, 254
127	127, 127
	1, 1

LCM of 254, 508 = 2 x 2 x 127 = 508

Thus, 508 is the smallest common number that is divisible by 254 and 508. Now, as we need remainder 4 while dividing, the required number is 4 more than the LCM and so, the required number is 508 + 4 =512.

Example 10: What is the smallest 5 digit number that is exactly divisible by 72 and 108?

Solution: First let us find the LCM of 72 and 108 (by division method).

2	72,108
2	36,54
2	18,27
3	9,27
3	3,9
3	1,3
	1,1

LCM of 72 and 108= 2 x 2 x 2 x 3 x 3 x 3 = 216

Now, all multiples of 216 will also be common multiples of 72 and 108.

The smallest 5 digit number = 10,000.

Now, 10,000 ÷ 216 gives quotient as 46 and remainder as 164.

Hence the next multiple of 216 i.e., 216 x 47 = 10,152 is the required smallest 5 digit number that is exactly divisible by 72 and 108.

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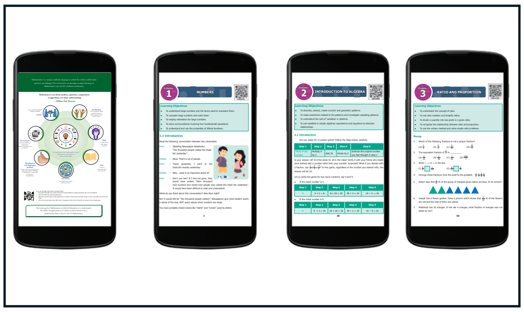
Example 11: There are four Mobile Phones in a house. At 5 a.m, all the four Mobile Phones will ring together. Thereafter, the first one rings every 15 minutes, the second one rings every 20 minutes, the third one rings every 25 minutes and the fourth one rings every 30 minutes. At what time, will the four Mobile Phones ring together again?

Solution: This is a LCM related sum. So, we need to find the LCM of 15, 20, 25 and 30.

2	15, 20, 25, 30
2	15, 10, 25, 15
5	15, 5, 25, 15
3	3, 1, 5, 3
5	1, 1, 5, 1
	1, 1, 1, 1



The LCM of 15, 20, 25 and 30 is 2 x 2 x 3 x 5 x 5

= 300 minutes = 5 x 60 minutes = 5 x 1 hour = 5 hours

Thus, the four Mobile Phones will ring together again at 10.00 a.m.

Try this

A small boy went to a town to sell a basket of wood apples. On the way, some robbers grabbed the fruits from him and ate them. The small boy went to the King and complained. The King asked him, "How many wood apples did you bring?". The boy replied, "Your Majesty! I didn't know, but I knew that if you divided my fruits into groups of 2, one fruit would be left in the basket". He continued saying that if the fruits were divided into groups of 3, 4, 5 and 6, the fruits left in the basket would be 2, 3, 4 and 5 respectively. Also, if the fruits were divided into groups of 7, no fruit would be there in the basket. Can you find the number of fruits, the small boy had initially?

(This problem is taken from the famous Mathematics problems collection book in Tamil called **"Kanakkathikaram"** under the heading of **"Wood Apple Problem"**)

1.8 Relationship between the Numbers and their HCF and LCM

Let us find the HCF and the LCM of 36 and 48. First, find the factors of 36 and 48 using division method.

36 = 2 x 2 x 3 x 3;   48 = 2 x 2 x 2 x 2 x 3

HCF = 2 x 2 x 3 = 12

LCM = 2 x 2 x 3 x 2 x 2 x 3 =144

Observe that, 36 x 48 = 144 x 12 = 1728

We find that,

product of two given numbers = their HCF x LCM

In general, for any 2 numbers x and y,

$$x \times y = \text{HCF}(x, y) \times \text{LCM}(x, y)$$

2	36
2	18
3	9
3	3
	1

2	48
2	24
2	12
2	6
3	3
	1

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Example 12: The LCM of two numbers is 432 and their HCF is 36. If one of the numbers is 108, then find the other number.

Solution: We know that, the product of the two numbers=LCM x HCF

108 x (the other number) = 432 x 36

The other number = (432 x 36) ÷ 108 = 144

Example 13: The LCM of two co-prime numbers is 5005. If one of the numbers is 65, then find the other number.

Solution: We know that, the product of the two numbers = LCM x HCF

As the HCF of co-primes is 1,

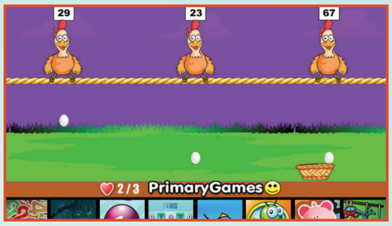
65 x (the other number) = 5005 x 1

The other number = 5005 ÷ 65 = 77

NUMBERS

ICT CORNER

Expected Outcome



Step 1

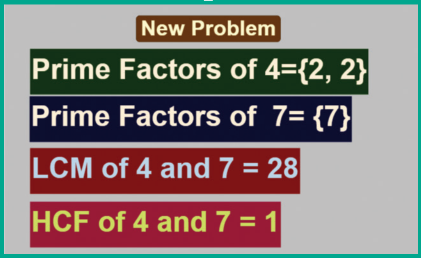
Open the Browser and type the URL Link given below (or) Scan the QR Code. GeoGebra work sheet named "Numbers" will open. The work sheet contains two activities. 1. LCM and HCF and 2. Prime number game.

In the first activity Click on New Problem and solve the problem, then check your answer.

Step 2

In the second activity catch the egg which shows prime number as quick as possible. You can select the level of speed in the beginning.

Step1



Step2

Browse in the link:

Numbers: https://ggbm.at/Exu3mtz5 or Scan the QR Code.

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Exercise 1.2

1. Fill in the blanks

(i) The HCF of 45 and 75 is _______.

(ii) The HCF of two successive even numbers is _________.

(iii) If the LCM of 3 and 9 is 9, then their HCF is _________.

(iv) The LCM of 26, 39 and 52 is______.

(v) The least number that should be added to 57 so that the sum is exactly divisible by 2,3, 4 and 5 is _________.

2. Say True or False

(i) The numbers 57 and 69 are co-primes.

(ii) The HCF of 17 and 18 is 1.

(iii) The LCM of two successive numbers is the product of the numbers.

(iv) The LCM of two co-primes is the sum of the numbers.

(v) The HCF of two numbers is always a factor of their LCM .

3. Find the HCF of each set of numbers using prime factorisation method.

(i) 18,24 (ii) 51,85 (iii) 61,76 (iv) 84,120 (v) 27,45,81 (vi) 45,55,95

4. Find the LCM of each set of numbers using prime factorisation method.

(i) 6,9 (ii) 8,12 (iii) 10,15 (iv) 14,42 (v) 30,40,60 (vi) 15,25,75

5. Find the HCF and the LCM of the numbers 154, 198 and 286.

6. What is the greatest possible volume of a vessel that can be used to measure exactly the volume of milk in cans (in full capacity) of 80 litres, 100 litres and 120 litres?

7. The traffic lights at three different road junctions change after every 40 seconds, 60 seconds and 72 seconds respectively. If they changed simultaneously together at 8 a.m at the junctions, at what time will they simultaneously change together again?

8. The LCM of two numbers is 210 and their HCF is 14. How many such pairs are possible?

9. The LCM of two numbers is 6 times their HCF. If the HCF is 12 and one of the numbers is 36, then find the other number.

Objective Type Questions

10. Which of the following pairs is co-prime?

a) 51, 63 b) 52, 91 c) 71, 81 d) 81, 99

11. The greatest 4 digit number which is exactly divisible by 8, 9 and 12 is

a) 9999 b) 9996 c) 9696 d) 9936

12. The HCF of two numbers is 2 and their LCM is 154. If the difference between the numbers is 8, then the sum is

a) 26 b) 36 c) 46 d) 56

13. Which of the following cannot be the HCF of two numbers whose LCM is 120?

a) 60 b) 40 c) 80 d) 30

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Exercise 1.3

Miscellaneous Practice Problems

1. Every even number greater than 2 can be expressed as the sum of two prime numbers. Verify this statement for every even number upto 16.
2. Is 173 a prime? Why?
3. For which of the numbers, from $n = 2$ to 8, is $2n-1$ a prime?
4. State true or false and explain your answer with reason for the following statements.
   a) A number is divisible by 9, if it is divisible by 3.
   b) A number is divisible by 6, if it is divisible by 12.
5. Find A as required:
   (i) The greatest 2 digit number 9A is divisible by 2.
   (ii) The least number 567A is divisible by 3.
   (iii) The greatest 3 digit number 9A6 is divisible by 6.
   (iv) The number A08 is divisible by 4 and 9.
   (v) The number 225A85 is divisible by 11.
6. Numbers divisible by 4 and 6 are divisible by 24. Verify this statement and support your answer with an example.
7. The sum of any two successive odd numbers is always divisible by 4. Justify this statement with an example.
8. Find the length of the longest rope that can be used to measure exactly the ropes of length 1m 20cm, 3m 60cm and 4m.

Challenge Problems

9. The sum of three prime numbers is 80. The difference of two of them is 4. Find the numbers.
10. Find the sum of all the prime numbers between 10 and 20 and check whether that sum is divisible by all the single digit numbers.
11. Find the smallest number which is exactly divisible by all the numbers from 1 to 9.
12. The product of any three consecutive numbers is always divisible by 6. Justify this statement with an example.
13. Malarvizhi, Karthiga and Anjali are friends and natives of the same village. They work at different places. Malarvizhi comes to her home once in 5 days. Similarly, Karthiga and Anjali come to their homes once in 6 days and 10 days respectively. Assuming that they met each other on the 1st of October, when will all the three meet again?

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14. In an apartment consisting of 108 floors, two lifts A & B starting from the ground floor, stop at every 3rd and 5th floors respectively. On which floors, will both of them stop together?

15. The product of 2 two digit numbers is 300 and their HCF is 5. What are the numbers?

16. Find whether the number 564872 is divisible by 88.
(use of the test of divisibility rule for 8 and 11 will help!)

17. Wilson, Mathan and Guna can complete one round of a circular track in 10, 15 and 20 minutes respectively. If they start together at 7 a.m from the starting point, at what time will they meet together again at the starting point?

DO YOU KNOW?

Two numbers are said to be ***amicable numbers*** if the sum of the factors of one number (except the number itself) gives the other number.

The numbers **220** and **284** are amicable, since the sum of the factors of **220** (except **220**) i.e., $1+2+4+5+10+11+20+22+44+55+110 = \mathbf{284}$ and the sum of the factors of **284** (except **284**) i.e., $1+2+4+71+142 = \mathbf{220}$.

Check whether **1184** and **1210** are amicable numbers.

Summary

- A natural number greater than 1, having only two factors namely 1 and the number itself, is called a *prime number*.
- A natural number having more than two factors is called a *composite number*.
- A pair of prime numbers whose difference is 2 is called as *twin primes*.
- Every composite number can be expressed as a product of prime numbers in a *unique way*.
- The *Highest Common Factor* of any two non-zero whole numbers is the largest common factor of both the numbers.
- The *Least Common Multiple* of any two non-zero whole numbers is the smallest common multiple of both the numbers.
- Two numbers having 1 as their only common factor are said to be *co-primes* or *relatively prime*.
- The product of two given numbers is equal to the product of their HCF and LCM.

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CHAPTER 2

MEASUREMENTS

AN9L0

Learning Objectives:

- To understand the position of decimal point in the conversion of smaller unit to larger unit and vice versa.
- To do the four fundamental operations on quantities of different units.
- To read time in a clock and convert the 12 hour format to the 24 hour format and vice versa.
- To find duration between 2 given time instances.
- To do conversion of units of time.

2.1 Introduction

Let us listen to the following conversation between a teacher and a student:

Teacher: Have you ever noticed your mother buying knotted flowers? How is it measured?

Student: Yes teacher. The flower seller measures the string of flowers using her/his hand. She/He measures in cubit (முழம் in tamil).

Teacher: If you measure the same using your hand, what would you observe?

Student: It would measure more than one cubit,because my hand is shorter.

Teacher: Yes, how far is your house from the school?

Student: Just 100 feet, teacher.

Teacher: How do you buy rice, milk, cloth from the shop?

Student: We buy the rice in kilogram, milk in litre , cloth in metre.

Teacher: How much time do you spend on your homework?

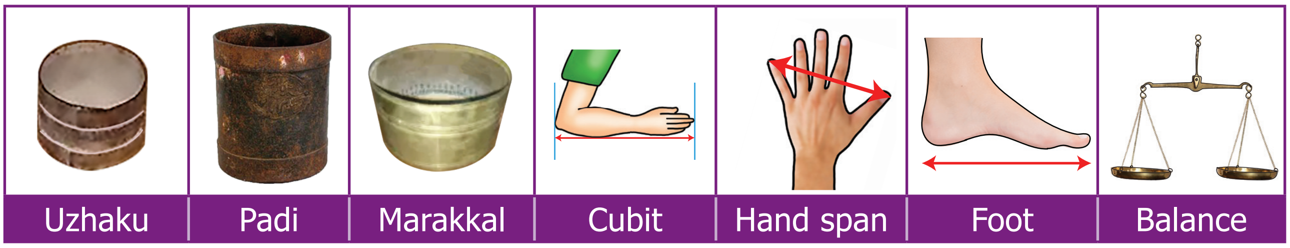
Student: I usually spend an hour to do my homework.

Teacher: How do you measure height and weight?

Student: Height in centimetre, Weight in kilogram.

Teacher: Have you heard about any other measures used in earlier days?

Student: My grandparents talk of measures used in their days such as Padi (படி), Uzhakku (உழக்கு), Aazhakku (ஆழாக்கு), Marakkal (மரக்கால்), Feet (அடி), Span (சாண்), Cubit (முழம்).



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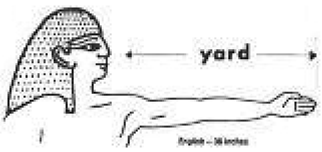
Teacher: Then why do we use kilogram, metre, litre instead of those units?

Student: I don't know teacher, please tell us why?.

Teacher: As we started trading world wide ,we found people in various places using different measures. The 'kings foot', the 'kings arm' and the 'yard' (the distance between the tip of his nose to the tip of the thumb) were used as units to measure small length in various places. As these lengths differed from person to person and place to place, it was necessary to standardize measurements throughout the world. The metric measures were defined in 1971 by the General Conference of Weights and Measures.



The basic metric units are Metre, Litre, Gram, Seconds and so on. It is based on the decimal system (10), which is easier to convert from one unit to another. We use kilometre, metre, centimetre, millimetre to measure length; kilogram, gram, milligram for weight and kilolitre, litre, millilitre for volume in shops, schools ,office, railways and many other places.

An eye blink represents a second; heart beats are counted per minute; working time of an employee is calculated in hours.

MATHEMATICS ALIVE – MEASUREMENTS IN REAL LIFE

Cloth measure in a textile shop

Weighing Vegetables in a market

Measuring the volume of milk by the seller

2.2 Recap

Universally accepted basic metric units are

- Length in metre.
- Weight in gram.
- Capacity (volume) in litre.

We use different metric units for different sizes in various situations

Size	Metric units
Large ones	Kilometre / Kilolitre / Kilogram
Medium ones	Metre / Litre /Gram
Small ones	Centimetre / Centilitre /Centigram
Very small ones	Millimetre/Millilitre / Milligram

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Try this

1. Complete the following table:

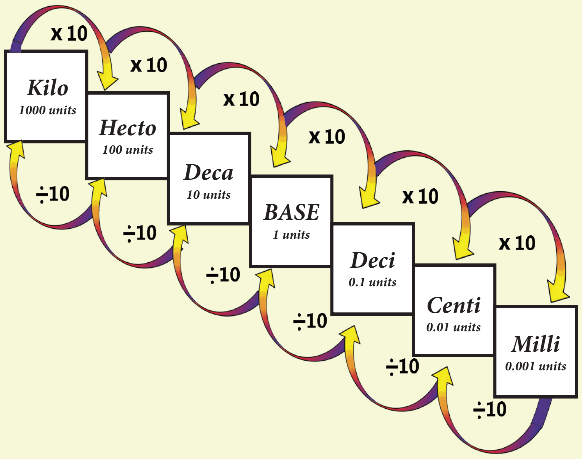
Metric Unit Table (Hierarchy of Units)						
For Length						
Kilometre (km)	Hectometre (hm)	Decametre (dam)	Metre (m)	Decimetre (dm)	Centimetre (cm)	Millimetre (mm)
For Weight						
			Gram			
For Volume						
			Litre			

2. Determine which metric unit you would use to express the following :

   i. The length of your middle finger.
   ii. The weight of an elephant.
   iii. The weight of the ring.
   iv. The weight of the tablet.
   v. The length of the safety pin.
   vi. The height of the building.
   vii. The length of the sea shore in tamilnadu.
   viii. The volume of cup of coffee.
   ix. The capacity of water in the tank.

2.3 Conversions within the Metric System

All units of length in the metric system are defined in terms of the metre. A prefix is added to indicate the decimal place value position of the measurements. Similarly the units of weight and volume are defined in terms of gram and litre respectively. Let us observe the conversion chart.



- When we move from higher unit to lower unit, multiply the given measure by the powers of 10's.
- When we move from lower unit to higher unit, divide the given measure by the powers of 10's.

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Remember the following Conversion table:

Length	Weight	Volume (Capacity)
• 1 *km* = 1000 *m* • 1 *m* = 100 *cm* • 1 *m* = 1000 *mm* • 1 *cm* = 10 *mm*	• 1 *kg* = 1000 *g* • 1 *g* = 1000 *mg*	• 1 *kl* = 1000 *l* • 1 *l* = 1000 *ml*

Before we study Conversion of metric units, we should learn about decimal point position when multiplying / dividing of a decimal number by the powers of ten.

When a decimal number is multiplied by 10, 100, 1000, 10000, we move the decimal point by 1, 2 ,3 ,4 places to the right respectively.	**When a decimal number is divided by 10, 100, 1000, or 10000, we move the decimal point 1, 2, 3, 4 places to the left respectively.**
Example: **Multiply 345.972 by 10,100,1000 and 10000** 345.972 × 10 = 3459.72 (move the decimal point by one place to the right) 345.972 × 100 = 34597.2 (move the decimal point by two places to the right) 345.972 × 1000 = 345972 (move the decimal point by three places to the right) 345.9720 × 10000 = 3459720 (move the decimal point by four places to the right) Since, there are only 3 digits in the decimal part, add a zero to the right and then place the decimal point.	**Example :** **Divide 647.39 by 10,100 and 1000 and 10000** $\frac{647.39}{10} = 64.739$ (move the decimal point one place towards its left) $\frac{647.39}{100} = 6.4739$ (move the decimal point two places towards its left) $\frac{647.39}{1000} = 0.64739$ (move the decimal point three places towards its left) $\frac{0647.39}{10000} = 0.064739$ (move the decimal point four places towards its left) Since there are only 3 digits in the integral part , add one zero and place the point before it.

Example 1: The official distance of Marathon race is 42.195 *km*. Express this distance in metre.

Solution : The official distance of Marathon race is 42.195 *km*.

$= 42.195 \times 1000\ m$

$= 42195\ m$

1 *km* = 1000 *m*

Example 2: The average rainfall of Tamilnadu is 998 *mm*. convert it into *cm*.

Solution : The average rainfall =998 *mm* = 998.0 x $\frac{1}{10}$ *cm*

$= \frac{998.0}{10}\ cm$

$= 99.8\ cm$

1 *cm* = 10 *mm*

$\frac{1}{10}$ *cm* = 1 *mm*

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Example 3: A flag pole is 5 m 35 cm long. What is the length of the flag pole in cm?

Solution : The length of a flag pole = 5 m 35 cm long

= (5× 100) cm + 35 cm

= 500 cm + 35 cm

= 535 cm

The flag pole is 535 cm long.

> 1 m = 100 cm

Example 4: Janaki bought 650 mg of a tablet. What is its weight in gram?

Solution : weight of a tablet = 650 mg

$$= 650.0 \times \frac{1}{1000} g$$

$$= \frac{650.0}{1000} g = 0.65\ g$$

> 1 g = 1000 mg
> $\frac{1}{1000}$ g = 1 mg

Example 5: Murali has a bag that weighs 3 kg and 450 g. What is its weight in gram?

Solution : weight of Murali's bag = 3 kg and 450 g ,

= (3x1000 g) + 450 g

= 3000 g + 450 g

= 3450 g

> 1 kg = 1000 g

Example 6: A calf drinks 5.750 l of water ,convert into ml

Solution : Quantity of water drunk by the calf = 5.750 l

= 5.750 x 1000 ml

= 5750 ml

> 1 l = 1000 ml

Example 7: Convert 526 ml into l

Solution : $$526\ ml = 526.0 \times \frac{1}{1000} l$$

$$= \frac{526.0}{1000} l = 0.526\ l$$

> 1 l = 1000 ml
> $\frac{1}{1000}$ l = 1 ml

Try these

Convert the following

i) 23 km into m
ii) 1.78 m into cm
iii) 7814 m into km
iv) 8.67 mm into cm
v) 16 l into ml
vi) 1500 ml into l
vii) 2360 l into kl
viii) 873 l into ml
ix) 40 mg into g
x) 1550g into kg
xi) 6.5 kg into g
xii) 723g into mg

Think

Which of these is heavier in weight? 5 kg of cotton; 5000 g of Iron

DO YOU KNOW?

Some measures that are not part of metric system.

➢ 1 *inch* = 2.54 cm	➢ 1 tonne = 1000 kg
➢ 1 m = 3.281 ft	➢ 1 quintal=100 kg
➢ 1 m = 39.37 *inches*	➢ 1 tonne = 10 quintal
➢ 1 ft = 0.305 m = 30.48 cm	➢ 1 soverign = 8 g
➢ 1 *mile* = 1.609 km	➢ TMC: (Thousand Million Cubic feet), 1 TMC =28,316,846,592 litres

> 1 kg = 1000 g
> $\frac{1}{4}$ kg = 250 g
> $\frac{1}{2}$ kg = 500 g
> $\frac{3}{4}$ kg = 750 g

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The following Tamil puzzle is taken from the famous Mathematics problems collection book in Tamil called "Kanakkathikaram" in which is a good example of conversion of units of distance :

முப்பத்தி ரண்டு முழம்உளமுட் பனையை
தப்பாமல் ஒந்தி தவழ்ந்தேறிச் – செப்பமுடச்
சாணேறி நான்குவிரற்கிழியும் என்பரே
நாணா தொரு நாள் நகர்ந்து

Meaning of this puzzle:

On a palm tree of height 32 cubit , a chameleon tried to reach the top of the tree. If it climbed one hand span on it but slipped four fingers on one day, in how many days will it reach the top of the tree?

Solution:

1 hand span = 12 fingers;
1 cubit = 2 hand spans = 24 fingers.

Height of the palm tree = 32 cubit = 32 x 24 fingers = 768 fingers.

Distance climbed in 1 day = 1 hand span = 12 fingers.

Distance slipped in 1 day = 4 fingers.

Actual distance climbed in 1 day = 12 – 4 = 8 fingers.

Number of days required to climb the top of the tree = 768/ 8 = 96 days

2.4 Fundamental Operations on Quantities with Different Units

We can do the basic operations on the metric units as we do the decimal operations. Note that, measurements with the same unit can be added/ subtracted, but unlike units of measurements should be converted into like units and then they can be added / subtracted.

Example 8: Saritha bought 6 m and 40 cm of cloth for herself and 3 m and 80 cm of cloth for her sister. What was the total length of the cloth bought by her?

Solution:

	m	cm
	1	
Length of cloth bought for Saritha	6	40
Length of cloth bought for Saritha's sister	3	80
Total length of the cloth	10m	20cm

Example 9: Pradeep travels 4 km and 350 m to reach to the market, while Kandan travels 6 km and 200 m to reach to the same market from their houses. How much distance does Kandan travel more than Pradeep?

Solution:

	km	m
	1000 m →	
Distance travelled by Kandan	5 ~~6~~	1200 ~~200~~
Distance travelled by Pradeep	4	350
Difference in distance of their travel	1km	850m

Kandan travelled 1 km and 850 m more than Pradeep.

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Example 10: A child needs 100 g of vegetables per day. How many kg of vegetables will be needed for a school of strength 90.

Solution :

Total strength of the school	= 90
Weight of vegetables for each child per day	= 100 g
Total weight of vegetables for 90 children per day	= 90 x 100 g
	= 9000 g
	= 9 kg.

Example 11: A bag contains 81 kg of sugar. If the shopkeeper fill up these into small packets of 750 g. each, then how many packets can be made from 81 kg of sugar?

Solution :

Quantity of sugar in the bag	= 81 kg
Quantity of sugar filled in each packet	=750 g
Number of packets required	= 81 kg÷750 g
	= 81x1000 g÷750 g
	= 81000 g÷750 g
	= 108

```
       108
750 ) 81000
      750
       6000
       6000
          0
```

Think

1. Five kilograms of compost is needed for a coconut tree for every six months. How many kilograms of compost is needed for 50 such coconut trees for one and half years.?
2. Is this correct? 4 m+3 cm =7 m
3. Can we add the following?
   i) 6l + 7kg, ii) 3 m +5 l iii) 400 ml +300 g

Exercise 2.1

1. Fill in the blanks

(i) 250 ml + $\frac{1}{2}$ l = ... l

(ii) 150 kg 200 g + 55 kg 750 g =......kg ....g

(iii) 20 l – 1 l 500 ml = ...l ....ml

(iv) 450 ml x 5 =....... l ...... ml

(v) 50 kg ÷ 100 g =.......

2. True or False

(i) Pugazhenthi ate 100 g of nuts which is equal to 0.1 kg.

(ii) Meena bought 250 ml of buttermilk which is equal to 2.5 l.

(iii) Karkuzhali's bag 1 kg 250 g and Poongkodi's bag 2 kg 750 g. The total weight of their bags 4 kg.

(iv) Vanmathi bought 4 books each weighing 500 g. Total weight of 4 books is 2 kg.

(v) Gayathri bought 1 kg of birthday cake. She shared 450 g with her friends. The weight of cake remaining is 650 g.

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3. Convert into indicated units:
   (i) 10 *l* and 50 *ml* into *ml* (ii) 4 *km* and 300 *m* into *m* (iii) 300 *mg* into *g*
4. Convert into higher units : (i) 13000 *mm* (*km, m, cm*) (ii) 8257 *ml* (*kl, l*)
5. Convert into lower units : (i) 15 *km* (*m, cm, mm*) (ii) 12 *kg* (*g, mg*)
6. Compare and put >or< or = in the following:
   (i) 800 *g* + 150 *g* □ 1 *kg* (ii) 600 *ml*+400 *ml* □ 1 *l*
   (iii) 6 *m* 25 *cm* □ 600 *cm*+25 *cm* (iv) 88 *cm* □ 8 *m* 8 *cm*
   (v) 55 *g* □ 550 *mg*
7. Geetha brought 2 *l* and 250 *ml* of water in a bottle. Her friend drank 300 *ml* from it. How much of water is remaining in the bottle?
8. Thenmozhi's height is 1.25 *m* now. She grows 5 *cm* every year. What would be her height after 6 years?
9. Priya bought $22\frac{1}{2}$ *kg* of onion, Krishna bought $18\frac{3}{4}$ *kg* of onion and Sethu bought 9 *kg* 250 *g* of onion. What is the total weight of onion did they buy?
10. Maran walks 1.5 *km* every day to reach the school while Mahizhan walks 1400 *m*. Who walks more distance and by how much?
11. In a JRC one day camp, 150 *gm* of rice and 15 *ml* oil are needed for a student. If there are 40 students to attend the camp how much of rice and oil are needed?
12. In a school,200 litres of lemon juice is prepared. If 250 *ml* lemon juice is given to each student, how many students get the juice?
13. How many glasses of the given capacity will fill a 2 litre jug?
    (i) 100 *ml*________ (ii) 50 *ml*______ (iii) 500 *ml*____
    (iv) 1 *l*______ (v) 250 *ml*______

Objective Type Questions

14. 9 *m* 4 *cm* is equal to __________
    a. 94 *cm* b. 904 *cm* c. 9.4 *cm* d. 0.94 *cm*
15. 1006 *g* is equal to __________
    a. 1 *kg* 6 *g* b. 10 *kg* 6 *g* c. 100 *kg* 6 *g* d. 1 *kg* 600 g
16. Every day 150 *l* of water is sprayed in the garden. Water sprayed in a week is _____
    a. 700 *l* b. 1000 *l* c. 950 *l* d. 1050 *l*
17. Which is the greatest? 0.007 *g*, 70 *mg*, 0.07 *cg*
    a. 0.07 *cg* b. 0.007 *g* c. 70 *mg* d. all are equal
18. 7 *km* – 4200 *m* is equal to __________
    a. 3 *km* 800 *m* b. 2 *km* 800 *m* c. 3 *km* 200 *m* d. 2 *km* 200 *m*

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2.5 Measures of Time

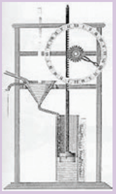
The teacher asks students to answer the following questions:

- How long do you take to run 100 metres?
- How long do you take to walk one kilometre?
- What is the time taken for a cup of rice to be cooked?
- What is the cultivation period of groundnut?

These questions will help us to find the importance of time in our day-to-day life. Now let us discuss the development of measures of time.

The procedure of measuring time has undergone several changes from ancient period. Initially, a stick in the sand was used to measure time by measuring the length of the shadow of that stick. Then horizontal and vertical plates were used as sundials to measure time between sunrise and sunset, that is in the day time. Firing of knotted ropes was used to measure time in the darkness. The approximate time taken for the fire to travel from one knot to other formed the part of night. In later days, a day was divided into 24 equal parts (hours) of which 12 hours were for daytime and 12 hours were for night time approximately. Time taken by the Earth to complete one full rotation around the Sun is known as the **Solar Year**. It was divided into 12 equal parts which is known as the **Solar month**. The duration between two full moons is known as the lunar month and 12 lunar months are known as lunar year. But we follow solar year and month.

Various clocks had been designed and used to measure time from different parts of world, like water clock, sun dial, candle clock, sand clock, rope clock, etc.... Have you seen those clocks? Look at the clocks shown below.

			
Water clock	**Sun dial**	**Candle Clock**	**Sand Clock**

Study of devices that are measuring the time is called **'HOROLOGY'**.

Nowadays, we use pendulum clock,digital clock, quartz clock, atomic clock to find time accurately.

DO YOU KNOW?

Our Tamil people were experts in the Astronomical science. The Tholkappiam deals the pozhuthu (time). They divide a day into six major divisions, together called **"Sirupozhuthu (சிறுபொழுது)"** . A year into six major divisons, together called **"Perumpozhuthu (பெரும்பொழுது)"**

1 Nazhigai = 24 min; 1 hour = 2.5 nazhigai = 1 Orai; 1 day = 24 hours = 60 nazhigai

[Tamil people used the device " kuri neer kannel" to measure night times...........]

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Unit of Time: Today we are measuring time accurately. The units of time are second, minute, hour, day, week, month, year, etc. They are interrelated.

Recap:

1. Read and write the time in the appropriate place.

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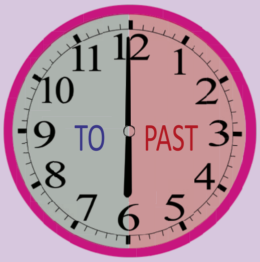
2.5.1 Reading the time

Practise to say time in two ways:-

When the minute hand is on the left hand side of the clock, (from 6 hours to 12 hours) we read the time as __ minute to ___hour. Example: 20 min to 10		When the minute hand is on the right hand side of the clock.(from 12 hours to 6 hours) we read the time as __ minute past ___hour. Example: 25 min past 4

Practise to say the time using **"past"**

4.00 4 o'clock	4.05 5 min past 4	4.10 10 min past 4	4.15 15 min past 4 or quarter past 4	4.20 20 min past 4	4.25 25 min past 4	4.30 30 min past 4 or half past 4

Practise to say the time using **"To"**

4.35 (i) 25 min to 5	4.40 (i) 20 min to 5	4.45 (i) 15 min to 5 or Quarter to 5	4.50 (i) 10 min to 5	4.55 (i) 5 min to 5

Try these

Say the following time in appropriate ways:

a) 9.20 b) 4.50 c) 5.15 d) 6.45 e) 11.30

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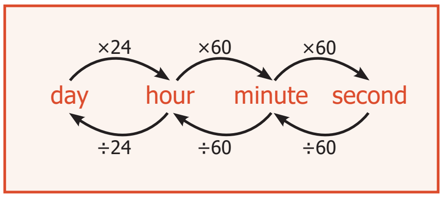
2.5.2 Conversion of Time

Calculation of time to the nearest seconds is very essential in some situations like launching rocket, running race, arrival and departure. So, we need to know the conversion of time.

Let us remember the time related chart as follows:



Example 12: A farmer ploughed the field for 3 hours 35 minutes. How many minutes did he plough?

Solution:

Time for which the farmer ploughed the field = 3 hours and 35 minutes
= 3 x 60 minutes + 35 minutes
= 180 minutes + 35 minutes
= 215 minutes

Examples 13: A handloom weaver takes 6 hours 20 minutes 30 seconds and 5 hours 50 minutes 45 seconds to weave two silk sarees. What is the total time to weave the two silk sarees?

Solution:

	Hours	Minutes	Seconds
Time taken to weave the first silk saree	6	20	30
Time taken to weave the second silk saree	5	50	45
Total time taken to weave the two silk sarees	11 hours	70 minutes	75 seconds
	= 11 hours	60 minutes+10 minutes	60 seconds+15 seconds
	= 11 hours	1 hour+10 minutes	1 minute + 15 seconds
	= 12 hours	11 minutes	15 seconds

Example 14: A satellite is placed in its orbit in 7 hours 16 minutes 20 seconds. Calculate it in seconds.

Solution: The satellite reaches its orbit in 7 hours + 16 minutes + 20 seconds
= (7 x 60 x 60) seconds +(16 x 60) seconds +20 seconds
= 25200 seconds + 960 seconds + 20 seconds
= 26,180 seconds

The satellite reaches its orbit in 26,180 seconds

Example 15: Two cyclists took 5 hours 35 minutes 10 seconds and 8 hours respectively to cover the same distance. Find the difference in time taken by them

Solution:

Hours	Minutes	Seconds
7 ~~8~~ (1 hour)	59 ~~60~~ ~~00~~ (1 minute)	60 ~~00~~
5	35	10
2	24	50

Try these

Convert the following:

i) 4 hours = ____ minutes
ii) 240 minutes = ____ hours
iii) 30 minutes = ____ seconds
iv) 3600 seconds = ____ hours
v) 2 hours = ____ seconds

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2.5.3 Ordinary Time or the 12-Hour Format

The 12 hour clock has ante meridiem (a.m) and post meridiem (p.m) because the number of hours in a day is divided into day and night. In the clock, exactly 12.00 at night is called midnight; and exactly 12.00 at day is called noon.

a.m (ante meridiem) denotes the time that is after 12:00 midnight and before 12:00 noon.

p.m (post meridiem) denotes the time that is after 12:00 noon and before 12:00 midnight.

Example:

- Morning 5 o' clock is denoted as 5.00 a.m
- Evening 5 o' clock is denoted as 5.00 p.m
- In 3.20 a.m., the point does not mean the usual decimal point.

2.5.4 Railway Time or the 24-Hour Format

Generally, we use 12 hour clock but Railways, Airways, Defence forces and Television networks use 24 hour clock to avoid morning or evening confusions. When you are in a railway station, you can hear the announcement and see the use of hours instead of a.m. and p.m, because they follow the 24 hour format. Therefore, there is no need to say morning and evening in their time. Railway time is usually denoted in **4 digits.** The first two digits shows the hours and the last two digits shows the minutes. For example, 5 p.m is denoted as **17:00 hours.**

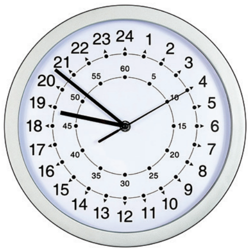
Example: 7 o' clock morning = 07:00 hours

1 o' clock evening = 13:00 hours (12+1 hour)

i.e., after 12 noon they count continuously up to 24 hours.

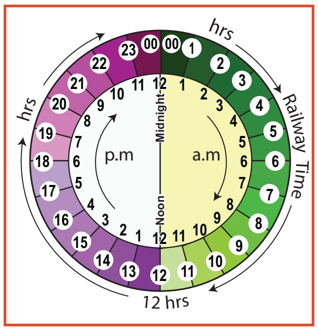
12 midnight is written as 00:00 hours or 24:00 hours.

12 noon is written as 12:00 hours



2.5.5 Conversion of Time Formats

Let us observe the clock. Remember the following points while converting from one type of time to another type



- To convert 12 hour time to 24 hour time, simply change 12 hours as 00:00 hours between 12.00 midnight and 01.00 a.m. There is no change upto 01.00 p.m. Add 12:00 hours to any hour from 01.00 p.m.
- To convert 24 hour time to 12 hour time simply change 00:00 hours as 12 hours between 00:00 hours and 01:00 hour. After that, there is no change upto 13:00 hours. Subtract 12:00 hours from any hours from 13:00 hours. Minutes will not change in both the formats.

Convert into the 12 hour format: (Ordinary time)

24 hour format	>12 hour	if >12 hour then subtract 12	12 hour format
09:25 hours	No	-	9.25 a.m
18:40 hours	Yes	18-12= 6	6.40 p.m
03:15 hours	No	-	3.15 a.m
15:30 hours	Yes	(15-12=3)	3.30 p.m
23:50 hours	Yes	(23-12=11)	11.50 p.m

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Convert into the 24 hour format (Railway time)

12 hour time	a.m/p.m	add 12 hr to p.m	24 hour time
04.15 a.m	a.m	-	04:15 hours
07.40 p.m	p.m	(7+12) hours	19:40 hours
10.05 p.m	p.m	(10+12) hours	22:05 hours
06.00 a.m	a.m	-	06:00 hours
12.25 a.m	a.m	-	00:25 hours

Try these

Convert the 12 hour format into the 24 hour format and vice versa

10.40 a.m	= 10:40 hours	1 p.m	= 13:00 hours
11 a.m	= 11:00 hours	11.15 p.m	= 23:15 hours
1.15 a.m	= ______hours	3 p.m	= ______hours
5 a.m	= ______hours	12 midnight	= ______hours
16:20 hours	= ______a.m/p.m	12:25 hours	= ______a.m/p.m
00:40 hours	= ______a.m/p.m	4:10 hours	= ______a.m/p.m

2.5.6 Duration between the two given time instances

Example16: Find the duration between 6 a.m and 4 p.m

Solution :

Method-1

Conversion of 6 a.m to Railway time

= 06:00 hours

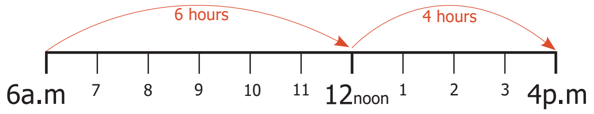
Conversion of 4 p.m to Railway time

= (4+12) hours = 16:00 hours

Time duration between 6 a.m and 4 p.m

= The difference between 16 hours and 6 hours = 16 hours – 6 hours = 10 hours

Method-2



= 6 hours + 4 hours = 10 hours

Example 17:

The arrival and departure timings of the Chennai – Trichy Express are given below.

Station	Arrival	Departure
Chennai Egmore	-	20:30
Chengalpattu	21:30	21:32
Villupuram junction	23:15	23:25
Virudhachalam junction	00:07	00:10
Trichy	04:30	-

(i) At what time does the train depart from Chennai Egmore to arrive at Trichy?
The train departs from Egmore at 20:30 hours to arrive Trichy at 4:30 hours.

(ii) How long does it halt at Villupuram?
It halts at Villupuram for 10 minutes.

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(iii) How many halts are there in between Chennai and Trichy ?
There are 3 halts (1) Chengalpattu (2) Villupuram (3) Virudhachalam

(iv) Find the total journey time of the train from Chennai to Trichy.

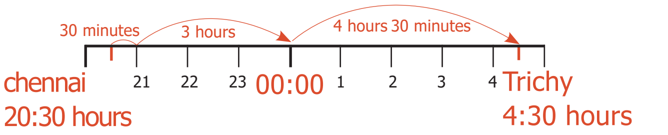
Hint: If the journey crosses the midnight, calculate the time duration from starting hours to midnight, then from midnight to arrival time.

Method-1

Duration up to midnight (1 hour)

Midnight	:	~~24~~ 23 : ~~00~~ 60 hours
Starting time	:	20 :30 hours
Duration		03:30 hours

Method-2



Total journey time = 3 hours 30 minutes+4 hours 30 minutes
= 7 hours 60 minutes
= 7 hours +1 hour = 8 hours

Duration from midnight to arrival = 4 hours 30 minutes
Total journey time = Duration up to midnight + Duration from midnight to arrival
= 3 hours 30 minutes + 4 hours 30 minutes
= 7 hours 60 minutes = 7 hours + 1 hour = 8 hours

Example 18:

The clock is set at 7 a.m. If the clock slows down two minutes every hour, find the time shown by the clock at 6 p.m.

Ordinary time	Railway time
6.00 p.m	18:00 hours
7.00 a.m	07:00 hours
Time duration	11:00 hours

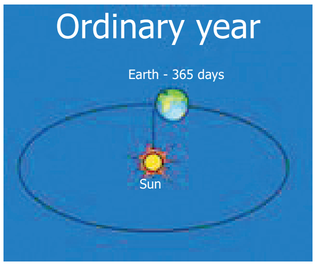
Solution : Time slowed down for 1 hour = 2 minutes
Time slowed down for 11 hours =11 x 2 = 22 minutes
So, at 6 p.m the clock slows down by 22 minutes. That means the clock shows 5 hours 38 minutes at 6 p.m.

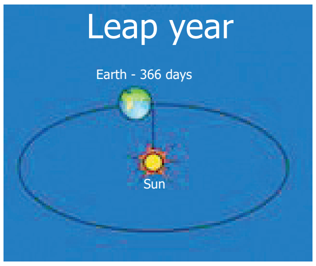
2.5.7 Year

A year is the time taken by the Earth to make one revolution around the Sun. A year has 12 months or 365 days. Each month is divided into weeks. A month has 4 weeks and a few more days. A week is of 7 days. A month has 30 days / 31 days except February. February has 28 or 29 days.

Leap Year

We know that the Earth revolves around the Sun as well as rotates to itself. The Earth takes 365 days 6 hours to make a complete revolution around the sun. We take 365 days as one year. To adjust 6 hours each year, we add one day to every fourth year (4 years × 6 hours = 24 hours = 1 day). Every 4th year has 365 +1 day = 366 days and one day is added to the month of February. Therefore a year which has 366 days is called a **Leap Year.** In a Leap Year the month of February has 29 days. Every year you are celebrating birthday. If a person's birthday falls on 29th February, he/she has to celebrate the birthday once in 4 years only.





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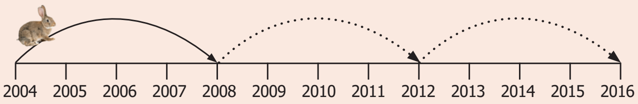
How can we identify a leap year?

I. Generally a year which is divisible by 4 is considered as a leap year.

Examples:

1. 2016 is a leap year, because 2016 is exactly divisible by 4
2. 2018 is not divisible by 4 and it leaves remainder. So it is not a leap year.

Leap means jumping from one point to another



II In centuries:

Years which are multiples of 100 are centuries, such as 1100, 1200, 1300….1900, 2000, 2100 ….etc. The century which is divisible by 400 is a leap year.

Think

Why do we divide the centuries by 400 to find whether it is leap year or not?

Examples:

1. 1200 is divisible by 400; and so it is a leap year.
2. 1700 is not divisible by 400. and so it is not a leap year.

Example 19: If Wednesday falls on 20th of December 2017. What is the day on 8th june 2018? Also say the number of days between these two dates.

Month	Days
December	12 (31 – 19)
January	31
February	28 (2018 is a non-leap year)
March	31
April	30
May	31
June	07
Total	**170 days**

```
    24
7 ) 170
    14
     30
     28
      2
```

170 day ÷ 7 (why?)

170 days = 24 weeks +2 days

Required day is the second day after Wednesday. Therefore 8th of june is Friday.

Example 20: Mala's date of birth is 20-11-1999. What is her age on 05-10-2018?

Solution:

Convert in the format : YYYY/MM/DD

YYYY	MM	DD
(12 months →)	(30 days →)	
2017	21 (9+12)	35 (5+30)
~~2018~~	~~10~~	~~05~~
1999	11	20
18 yrs	10 months	15 days

Mala's age : 18 yrs 10 months 15 days

Activity

1. Collect some famous personalities whose birthday falls on 29th February.
2. Collect the interesting facts about Big Ben clock in London.

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Try these

1. Check whether the following years are Ordinary or Leap Year?
   1994; 1985; 2000; 2007; 2010; 2100
2. How many days are there from 1st April to 30th June?

DO YOU KNOW?

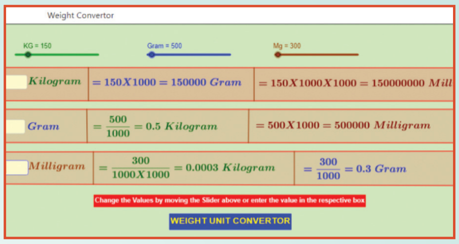
A Jubilee is a particular anniversary of an event.	
Silver Jubliee	25th anniversary
Ruby Jubilee	40th anniversary
Golden Jubilee	50th anniversary
Diamond Jubilee	60th anniversary
Sapphire Jubilee	65th anniversary
Platinum Jubilee	70th anniversary

- 10 years = 1 decade
- 100 years = 1 century
- 1000 years = 1 millennium
- 21st century 2001 – 2100, we are in this century
- 3rd millennium - 2001 – 3000 yrs, we are in this millennium

ICT CORNER

Measurements

Expected Outcome



Step 1

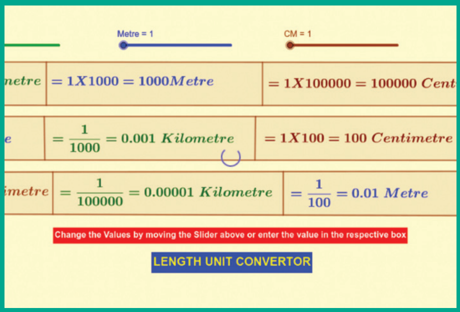
Open the Browser and type the URL Link given below (or) Scan the QR Code. GeoGebra work sheet named “Measurement Unit convertor” will open. The work sheet contains three activities.
1. Length convertor and **2.** Weight convertor and **3.** Convertor for all measurements

In the first activity move the sliders to change the value of kilometre, metre and centimetre and check the conversion.

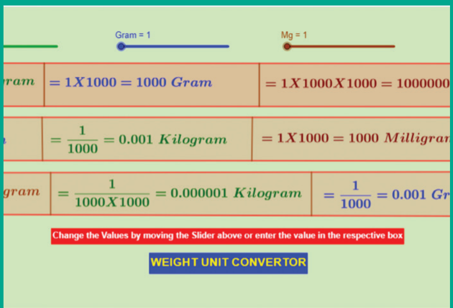
Step 2

In the second activity move the sliders to change the value of Kilogram, Gram and Milligram and check the conversion.

Step1



Step2



Browse in the link:

Measurements: https://ggbm.at/p7DZHP6K or Scan the QR Code.

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Exercise 2.2

1. Say the time in two ways:

i.	ii.	iii.	iv.	v

2. Match the following:

(i) 9.55	a. 20 minutes past 2
(ii) 11.50	b. quarter past 4
(iii) 4.15	c. quarter to 8
(iv) 7.45	d. 5 minutes to 10
(v) 2.20	e. 10 minutes to 12

74HOI

3. Convert the following:

   (i) 20 minutes into seconds

   (ii) 5 hours 35 minutes 40 seconds into seconds

   (iii) $3\frac{1}{2}$ hours into minutes

   (iv) 580 minutes into hours

   (v) 25200 seconds into hours

4. The duration of electricity consumed by the farmer for his pumpset on Monday and Tuesday was 7 hours 20 minutes 35 seconds and 3 hours 44 minutes 50 seconds respectively. Find the total duration of consumption of electricity.

5. Subtract 10 hours 20 minutes 35 seconds from 12 hours 18 minutes 40 seconds

6. Change the following into 12 hour format

   (i) 02:00 hours (ii) 08:45 hours

   (iii) 21:10 hours (iv) 11:20 hours (v) 00:00 hours

7. Change the following into 24 hour format

   (i) 3.15 a.m (iii) 12.35 p.m

   (iv) 12.00 noon (v) 12.00 midnight

8. Calculate the duration of time

   (i) from 5.30 a.m to 12.40 p.m

   (ii) from 1.30 p.m to 10.25 p.m

   (iii) from 20:00 hours to 4:00 hours

   (iv) from 17:00 hours to 5:15 hours

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9. The departure and arrival timing of the Vaigai Superfast Express (No. 12635) from Chennai Egmore to Madurai Junction are given. Read the details and answer the following.

Station	Arrival	Departure
Chennai Egmore	-	13:40
Tambaram	14:08	14:10
Chengalpattu	14:38	14:40
Villupuram	15:50	15:55
Virudhachalam	16:28	16:30
Ariyalur	17:04	17:05
Trichy	18:30	18:35
Dindigul	20:03	20:05
Sholavandan	20:34	20:35
Madurai	21:20	-

(i) At what time does the Vaigai Express start from Chennai and arrive at Madurai?
(ii) How many halts are there between Chennai and Madurai?
(iii) How long does the train halt at the Villupuram junction?
(iv) At what time does the train come to Sholavandan?
(v) Find the journey time from Chennai Egmore to Madurai?

10. Manickam joined a chess class on 20.02.2017 and due to exam, he left practice after 20 days. Again he continued practice from 10.07.2017 to 31.03.2018. Calculate how many days did he practice?

11. A clock gains 3 minutes every hour. If the clock is set correctly at 5 a.m, find the time shown by the clock at 7 p.m?

12. Find the number of days between the Republic day and Kalvi Valarchi Day in 2020.

13. If 11th of January 2018 is Thursday , what is the day on 20th July of the same year?

14. (i) Convert 480 days into years.
(ii) Convert 38 months into years.

15. Calculate your age as on 01.06.2018

Objective Type Questions

16. 2 days =_________ hours.

a) 38 b) 48 c) 28 d) 40

17. 3 weeks = _________ days

a) 21 b) 7 c) 14 d) 28

18. Number of ordinary years between two consecutive leap years is _________

a) 4 years b) 2 years

c) 1 year d) 3 years

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19. What time will it be 5 hours after 22:35 hours ?

a) 2:30 hours   b) 3:35 hours

c) 4:35 hours   d) 5:35 hours

20. $2\frac{1}{2}$ years is equal to __________ months.

a) 25   b) 30   c) 24   d) 5

Exercise 2.3

Miscellaneous practice Problems

1. Two pipes whose lengths are 7 m 25 cm and 8 m 13 cm joined by welding and then a small piece 60 cm is cut from the whole. What is the remaining length of the pipe?
2. The saplings are planted at a distance of 2 m 50 cm in the road of length 5 km by saravanan. If he has 2560 saplings, how many saplings will be planted by him? how many saplings are left?
3. Put ✓mark in the circles which adds upto the given measure.

1.	1 *Kg*	○ 500 *g*	○ 50 *g*	○ 100 *g*	○ 200 *g*	○ 250 *g*
2.	1 *m*	○ 10 *cm*	○ 30 *cm*	○ 40 *cm*	○ 25 *cm*	○ 5 *cm*
3.	1 *l*	○ 200 *ml*	○ 100 *ml*	○ 50 *ml*	○ 500 *ml*	○ 200 *ml*

4. Make a calendar for the month of February 2020. (Hint: January 1st 2020 is Wednesday)

5. Observe and Collect the data for a minute:

i.	Number of times a person breathes		ii.	Number of situps	
ii.	Number of times heart beats		iv.	Number of claps	
iii.	Number of times the eyes blink		vi.	Number of lines to write	
iv.	Distance by walking		viii.	Number of lines to read	
v.	Distance by running		x.	Number of Tamil verbs to say	

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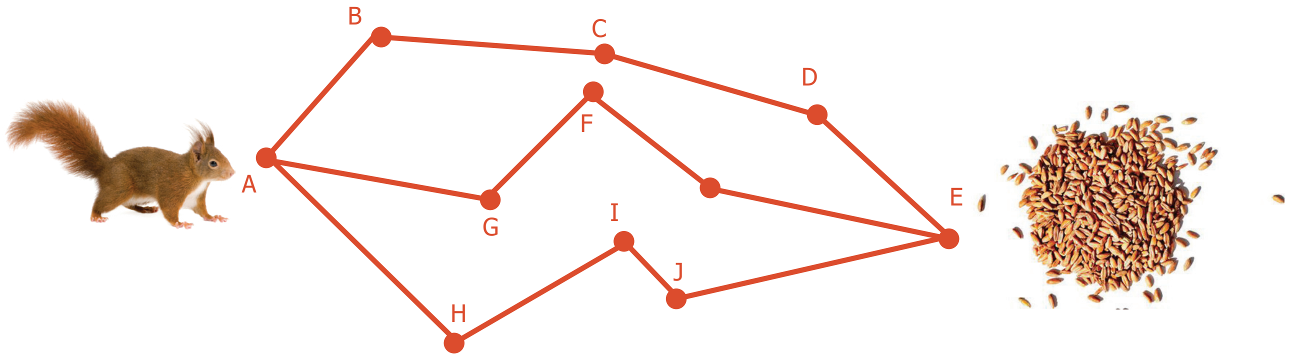
Challenge Problems

6. A squirrel wants to eat the grains quickly. Help the Squirrel to find the shortest way to reach the grains. (Use your scale to measure length of the line segments)



7. A room has a door whose measures are 1 m wide and 2 m 50 cm high.
   i. Can we take a bed of 2 m and 20 cm length and 90 cm wide into the room.?
8. A post office functions from 10 a.m to 5.45 p.m with a lunch break of 1 hour. If the post office works for 6 days a week, find the total duration of working hours in a week.
9. Seetha wakes up at 5.20 a.m. She spends 35 minutes to get ready and travels 15 minutes to reach the railway station. If the train departs exactly at 6:00 a.m, will Seetha catch the train?
10. A doctor advised Vairavan to take one tablet every 6 hours once in the 1st day and once every 8 hours on the 2nd and 3rd day. If he starts to take 9.30 a.m first dose. Prepare a time chart to take tablet in railway time.

Summary

- Basic metric units of length is metre, weight is gram and capacity (volume) is litre.
- Different unit measurements should be converted into same unit for addition and subtraction of units.
- **a.m** (ante meridiem) denotes the time that is after 12:00 midnight and before 12:00 noon.
- **p.m** (post meridiem) denotes the time that is after 12:00 noon and before 12:00 midnight.
- To convert 12 hour time to 24 hour time, add 12 to any hours 1p.m to 11p.m and change 12a.m as 00:00 hours
- To convert given time greater than 12 in railway time to an ordinary time, subtract 12 from it.
- Ordinary and Railway time are the same in a.m and it is less than 12.
- In both the formats there is no change in minutes.
- A year which is divisible by 4 is considered as a leap year.
- A century year which is divisible by 400 is a leap year.

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CHAPTER 3

BILL, PROFIT AND LOSS

5KCSU

Learning Objectives

- To prepare a bill and verify the bill amount.
- To calculate profit and loss.
- To calculate Cost Price (C.P.), Selling Price (S.P.), Marked Price (M.P.) and Discount.

3.1 Introduction

As everyone cannot produce each and every commodity that he/she uses in the day-to-day life, one has to buy them from companies, firm, stores, shops or individuals. In all these activities, business takes place. So, business is an organised effort of individuals to produce and sell the commodities that satisfies the needs of the society. Every business involves bills, profit, loss etc.

In this chapter, we are going to learn about the bills that we come across in everyday life. Also, we will learn about profit and loss in a transaction of a business.

MATHEMATICS ALIVE – BILL, PROFIT AND LOSS IN REAL LIFE

CHITRA BOOK SHOP

Gandhi Nagar, Kumbakonam

Bill No: 269 Phone No : 0435 00000001

Date : 10/07/2018

	Detail	Qty	Rate Rs	Rate P	Total Rs	Total P
1	Text Note (ruled)	1	25	00	25	00
2	Text Note (unruled)	1	25	00	25	00
3	School Bag	1	200	00	200	00
	In words : Two Hundred and Fifty Rupees Only				250	00

An example of Bill

An example of Sale Counter

3.2 Bill

Kothai is getting ready for Term – II studies in her school. Her mother gives Kothai ₹300 to purchase the stationery items like note book, pen, pencil, geometry box etc. Kothai purchased some stationery items and brought home the following bill.

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CASH BILL ABC STATIONERY MART, PERIYAR SALAI, ERODE				
Bill No. 75				Date : 20.04.2018
Sl. No.	Items	Quantity	Rate (in ₹)	Amount (in ₹)
1.	192 pages unruled note books	3	21	63
2.	Ink pen	2	35	70
3.	Pencil	2	15	30
4.	Eraser	1	5	5
5.	Geometry Box	1	52	52
	Total	9		220

From the above bill, Kothai understands that the bill has the following details.

1. Name of the shop.
2. Serial number of the bill.
3. Date on which the bill is produced.
4. The list of items purchased.
5. Cost of each item.
6. Total number of items purchased.
7. Amount paid for the purchase.
8. Tax details. You will learn in the higher classes.

After the purchase, she has some amount left with her. She wants to verify whether the expenses made by her are correct.

3.2.1 Verification of Bill

Kothai verifies the above bill as follows :

Item 1.	21×3	=	63	✓
Item 2.	35×2	=	70	✓
Item 3.	15×2	=	30	✓
Item 4.	5×1	=	5	✓
Item 5.	52×1	=	52	✓
			220	✓

Think

If 55 bills are produced on a day, then which information is same on all the bills?

Kothai's father asks some questions about the bill and Kothai answers him as follows.

(i) How many notebooks are purchased ? 3

(ii) What is the cost of each pen ? ₹35

(iii) What is the amount paid for pencils ? ₹30

(iv) How much the shopkeeper will give you back if you give 3 currencies of ₹100 ? ₹80

Activity

Raise a few more questions on this bill.

3.2.2 Preparation of a Bill

Arivu purchased the following vegetables from a petty shop.

2 kg of Brinjal @ ₹12 per kg, 3 kg of Onion @ ₹16 per kg, 3 kg of Tomato @ ₹20 per kg and 2 kg of Potato @ ₹24 per kg.

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The shopkeeper of a petty shop doesn't provide the bill. So, Arivu prepares the bill as follows, which helps him to verify whether he has paid correct amount for the purchase.

DO YOU KNOW?

@ represents "at the rate of"

CASH BILL PQR VEGETABLE SHOP VIVEKANANDA STREET, TRICHY				
Bill No. 786				Date : 25.04.2018
Sl. No.	Items	Quantity (in kg)	Rate (in ₹)	Amount (in ₹)
1.	Brinjal	2	12	24
2.	Onion	3	16	48
3.	Tomato	3	20	60
4.	Potato	2	24	48
	Total			180

Think

Will there be any change in the value of the bill if the columns 'Rate' and 'Quantity' are interchanged?

Example 1: Ramya purchases some make-up items and gets the following bill.

CASH BILL SHANTHI FANCY STORE				
Bill No. 100				Date : 15.05.2018
Sl. No.	Items	Rate (in ₹)	Quantity	Amount (in ₹)
1.	Hair clip	15 each	6	90
2.	Hair pin	10 each	4	40
3.	Ribbon	12 per m	3	36
4.	Handkerchief	25 each	2	50
	Total			216

Observe the bill and answer the following questions.

(i) What is the bill number?
(ii) Mention the date of the bill.
(iii) How many different items were purchased?
(iv) What is the cost of an hair clip?
(v) What is the total cost of the ribbon?

Solution :

(i) The bill number is 100.
(ii) The date of the bill is 15.05.2018.
(iii) There were four different items purchased.
(iv) The cost of 1 hair clip is ₹15.
(v) The total cost for the ribbon is ₹36.

Note

Most of the bills will have GST in them. GST stands for Goods and Services Tax, which is a single indirect tax in India which has been recently introduced to replace all other taxes like Service Tax, VAT, etc. The GST is imposed at various rates on various items. The GST is of two types. They are Central GST (CGST) and State GST (SGST).

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Example 2: Prepare a bill for the following purchases at Aavin sales counter in Coimbatore on 25-06-2018 bearing the Bill number 160.

1. 5 packets Milk Khoa of 100 gm @ ₹40 each
2. 5 packets of Butter Milk @ ₹8 each
3. 6 packets Milk of 500ml @ ₹25 each
4. 5 packets Ghee of 100gm @ ₹40 each

Solution :

1.	Milk Khoa	⇒	5 × ₹40	= ₹200
2.	Butter Milk	⇒	5 × ₹ 8	= ₹ 40
3.	Milk	⇒	6 × ₹25	= ₹150
4.	Ghee	⇒	5 × ₹40	= ₹200
			Total	₹590

CASH BILL
AAVIN PARLOUR, COIMBATORE

Bill No. 160   Date : 25.06.2018

Sl. No.	Items	Rate (in ₹)	Quantity (packets)	Amount (in ₹)
1.	Milk Khoa	40/packet	5	200
2.	Butter milk	8/packet	5	40
3.	Milk	25/packet	6	150
4.	Ghee	40/packet	5	200
	Total			590

3.3 Profit and Loss

In our day-to-day life, we use many commodities like food, clothes, vehicles, books etc. Everything is produced by someone or by a team of people and sold directly to the people or through the dealers. When we buy anything, a dealer charges more than what the manufacturer charges. Because, the dealer invests some money to buy the goods, spends his time to bring them to his place and he wants to earn a bit more money than his investment. The excess money that the dealer collects from the people is called **gain** or **profit**. If he is in the situation of collecting less money than what he has paid to the manufacturer due to the urgent need of money or some other reason, he loses some money. This losing of money in his investment is called **loss**. This process of buying and selling goods involves either profit or loss. We shall discuss this in detail.

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Cost Price (C.P.)

Think

The C.P. of a commodity differs from the manufacturer to the dealer or the shopkeeper. Why? Discuss.

A shopkeeper purchases goods from a manufacturer or a supplier. This is called Purchase Price. He also meets out the overhead expenses like transport charges, wages, etc. So, the **Cost Price (C.P.)** consists of the capital, the cost of raw materials, the labour charges for production, the electricity charges, the transport charges etc.

C.P. = Purchase price + Overhead expenses

For example, ABC Cars, the car manufacturing company buys raw materials for ₹2,00,000 per car, pays ₹70,000 to labourers, ₹15,000 towards electricity bill, ₹10,000 towards transports. Therefore, the Cost Price (C.P.) of a car produced is
₹2,00,000 + ₹70,000 + ₹15,000 + ₹10,000 = ₹2,95,000.

Note

The shopkeeper may require to spend some amount to bring the purchased commodities, like transport charges, wages to workers, toll fee etc., which come as part of "overhead expenses".

Marked Price (M.P.)

When a shopkeeper takes the goods from the dealer to his outlet for sales, he has to make profit in his business. So, he marks the price higher than the cost price of the goods. This price is called as **Tag price or Marked Price (M.P.)**.

In the above example, ABC cars likes to make ₹50,000 as its profit. So, it fixes up the Marked Price (M.P.) of the car as ₹2,95,000 + ₹50,000 = ₹3,45,000.

Discount

The reduction of cost on the Marked Price for the purpose of attracting the customers or some other reasons is called **Discount**.

To increase the sales, ABC cars is ready to reduce ₹5,000 to its customers, who is buying the car. Here the discount is ₹5,000.

Note

M.R.P. is Maximum Retail Price, which is fixed by the manufacturer. No commodity can be sold beyond this price.

Think

Which is greater M.P. or C.P?

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Selling Price (S.P.)

The amount that a customer pays to a commodity, after availing the discount (wherever possible) is called as **Selling Price (S.P.)**.

The Marked Price of the car is ₹3,45,000. The S.P. of the car sold by ABC cars is ₹3,45,000 – ₹5,000 = ₹3,40,000. i.e., **M.P. – Discount = S.P.**

From the above discussion we can come to the following conclusions.

- If C.P. < S.P., there is Profit ⇒ Profit = S.P. – C.P.
- If C.P. > S.P., there is loss ⇒ Loss = C.P. – S.P.
- If C.P. = S.P., there is no profit or loss.
- Discount = M.P. – S.P. (or) S.P. = M.P. – Discount.
- If there is no discount, then M.P. = S.P.

Example 3: Fill up the appropriate boxes in the following table:

	C.P.	S.P.	Profit	Loss
(i)	₹50	₹60		
(ii)	₹70	₹60		
(iii)	₹100		₹20	
(iv)	₹80			₹15
(v)		₹70	₹25	
(vi)		₹100		₹30

Try these

Arrange in ascending order:

(i) C.P., M.P., Discount

(ii) M.P., S.P., Discount

Solution :

(i) C.P. < S.P. ⇒ Profit = S.P. – C.P. = ₹60 – ₹50 = ₹10

(ii) C.P. > S.P. ⇒ Loss = C.P. – S.P. = ₹70 – ₹60 = ₹10

(iii) Profit = S.P. – C.P.

⇒ ₹20 = S.P. – ₹100

⇒ S.P. = ₹20 + ₹100 = ₹120

(iv) Loss = C.P. – S.P.

⇒ ₹15 = ₹80 – S.P.

⇒ S.P. = ₹80 – ₹15 = ₹65

(v) Profit = S.P. – C.P.

⇒ ₹25 = ₹70 – C.P.

⇒ C.P. = ₹70 – ₹25 = ₹45

Think

Which is greater S.P. or M.P.?

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(vi) Loss = C.P. – S.P.

⇒ ₹30 = C.P. – ₹100

⇒ C.P. = ₹30 + ₹100 = ₹130

Example 4: A table is bought for ₹4500 and sold for ₹4800. Find the profit or loss.

Solution:

C.P. = ₹4500

S.P. = ₹4800

Here, C.P. < S.P. ⇒ Profit = S.P. – C.P.
= ₹4800 – ₹4500 = ₹300

Example 5: A fruit seller bought a basket of fruits for ₹500. During the transit some fruits were damaged. So, he was able to sell the remaining fruits for ₹480. Find the profit or loss in his business.

Solution :

C.P. = ₹500

S.P. = ₹480

Here, C.P. > S.P. ⇒ Loss = C.P. – S.P. = ₹500 – ₹480 = ₹20

Example 6: Pari bought a Motor cycle for ₹55,000 and he gained ₹5500 on selling the same. What is the selling price of the motor cycle?

Solution :

C.P. = ₹55,000

Profit = ₹5,500

Profit = S.P. – C.P.

₹5,500 = S.P. – ₹55,000

S.P.= ₹5,500 + ₹55,000 = ₹60,500

Example 7: Manimegalai purchased a house for ₹25,52,500 and spent ₹2,28,350 for its repair. She sold it for ₹30,52,000. Find her gain or loss.

Solution :

C.P. = ₹25,52,500 + ₹2,28,350 = ₹27,80,850

S.P. = ₹30,52,000.

C.P. < S.P. ⇒ Profit = S.P. – C.P.= ₹30,52,000 – ₹27,80,850 = ₹2,71,150.

Example 8: A man bought 75 Mangoes for ₹300 and sold 50 Mangoes for ₹300. If he sold all the mangoes at the same price, find his profit or loss.

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Solution :

If the man bought 75 Mangoes for ₹300 then, Cost Price of 1 Mango = 300/75 = ₹4

If 50 Mangoes were sold for ₹300 then, Selling Price of 1 Mango is 300/50 = ₹6

∴ Selling price of 75 Mangoes at the rate of ₹6 is 75 x 6 = ₹450

Selling Price > Cost Price

∴ Profit = Selling Price – Cost Price = 450 – 300 = ₹150

Example 9: A fruit seller bought a dozen apples for ₹84. 2 apples got rotten. If he has to get a profit of ₹16, find the S.P. of each apple.

Solution :

Cost price of 12 apples = ₹84.

Since 2 apples got rotten, the number of remaining apples = 10

Since profit is ₹16, Selling price of 10 apples = C.P. + Profit = ₹84 + ₹16 = ₹100

∴ Selling price of 1 apple = 100/10 = ₹10

Example 10: Wheat is being sold at ₹1550 per bag of 25 kg at a profit of ₹150. Find the cost price of the wheat bag.

Solution :

Selling price = ₹1550

Profit = ₹150

Profit = S.P. – C.P.

₹150 = ₹1550 – C.P.

Cost price = ₹1550 – ₹150 = ₹1400

Example 11: Complete the following table.

Sl. No	C.P. in ₹	M.P. in ₹	S.P. in ₹	Discount in ₹	Profit in ₹	Loss in ₹
i	110	130		5		
ii	110	130		20		
iii		130		15	30	
iv		130		Nil		25
v		125		Nil	Nil	Nil
vi			350	50	100	Nil

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Solution:

(i) C.P. = ₹110
M.P. = ₹130
Discount = ₹5
S.P. = M.P. – Discount
= ₹130 – ₹5
= ₹125
Profit = S.P. – C.P.
= ₹125 – ₹110
= ₹15

(ii) C.P. = ₹110
M.P. = ₹130
Discount = ₹20
S.P. = M.P. – Discount
= ₹130 – ₹20
= ₹110
C.P. = S.P. ⇒ No profit or No loss.

(iii) M.P. = ₹130
Discount = ₹15
S.P. = M.P. – Discount
= ₹130 – ₹15
= ₹115
Profit = ₹30
Profit = S.P. – C.P.
₹ 30 = ₹115 – C.P.
C.P. = ₹115 – ₹30
= ₹85

(iv) M.P. = ₹130
Loss = ₹25
S.P. = M.P. – Discount
= ₹130 – ₹0
= ₹130
Loss = C.P. – S.P.
₹25 = C.P. – ₹130
C.P. = ₹25 + ₹130
= ₹155

(v) M.P. = ₹125
Discount = ₹0
S.P. = M.P. – Discount
= ₹125 – ₹0
= ₹125
No profit / No loss
C.P. = S.P.
C.P. = ₹125

(vi) S.P. = ₹350
Discount = ₹50
Profit = ₹100
M.P. = S.P.+ Discount
= ₹350+₹50 = ₹400
Profit = S.P. – C.P.
₹100 = ₹350 – C.P.
C.P. = ₹350 – ₹100
= ₹250

Example 12: Barathan offers his customers a discount of ₹50 on each shirt and still makes a profit of ₹100 per shirt. What is the actual cost price of the shirt that is marked @ ₹800 ?

Solution :

Discount = ₹50
Profit = ₹100

M.P. = ₹800
S.P. = M.P. – Discount
= ₹800 – ₹50
= ₹750
Profit = S.P. – C.P.
₹100 = ₹750 – C.P.
C.P. = ₹750 – ₹100
= ₹650

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Example 13: Raghu buys a chair for ₹3000. He wants to sell it at a profit of ₹500 after making a discount of ₹300. What is the M.P. of the chair?

Solution :

C.P. = ₹3000; Profit = ₹500; Discount = ₹300

S.P. = M.P. – Discount = M.P. – ₹300

Profit = S.P. – C.P.

₹500 = M.P. – ₹300 – ₹3000

M.P. = ₹500 + ₹300 + ₹3000 = ₹3800

Example 14: Mani buys a gift article for ₹1500. He wants to sell it at a profit of ₹150 on sales and he marks @ ₹1800. What is the discount that he will give to his customers?

Solution :

C.P. = ₹1500; Profit = ₹150; M.P. = ₹1800

S.P. = M.P. – Discount = ₹1800 – Discount

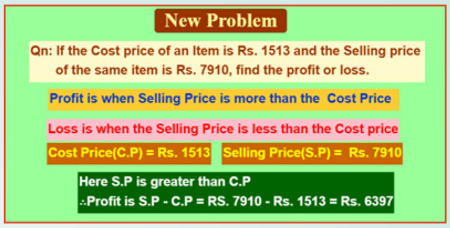
Profit = S.P. – C.P. ⇒ ₹150 = ₹1800 – Discount – ₹1500

Discount = ₹1800 – ₹1500 – ₹150 = ₹150

BILL, PROFIT and LOSS

ICT CORNER

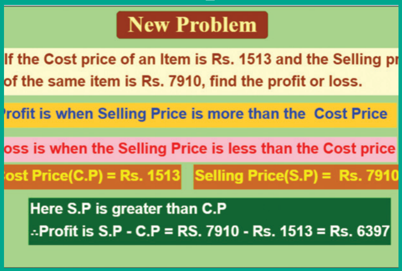
Expected Outcome



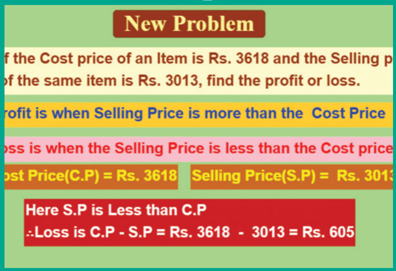
Step 1 Open the Browser and type the URL Link given below (or) Scan the QR Code. GeoGebra work sheet named "Profit and Loss" will open. The work sheet contains two activities. Click on "New Problem to change the problem. Read the given problem carefully.

Step 2 Work out yourself and check whether the answer is correct.

Step1



Step2



Browse in the link:

BILLS, PROFIT and LOSS: https://ggbm.at/p7DZHP6K or Scan the QR Code.

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Exercise 3.1

1. A school purchases some furniture and gets the following bill.

CASH BILL MULLAI FURNITURE MART, THANJAVUR				
Bill No. 728				Date : 23.04.2018
Sl. No.	**Items**	**Quantity**	**Rate (in ₹)**	**Amount (in ₹)**
1.	Sitting bench	50	1200	60,000
2.	Writing desk	50	1500	75,000
3.	Black board	2	3000	6,000
4.	Chair	10	950	9,500
5.	Table	10	1750	17,500
	Total			1,68,000

Questions:

(i) What is the name of the store?

(ii) What is the serial number of the bill?

(iii) What is the cost of a black board?

(iv) How many sets of benches and desks does the school buy?

(v) Verify whether the total bill amount is correct.

2. Prepare a bill for the following books of biographies purchased from Maruthu Book Store, Chidambaram on 12.04.2018 bearing the bill number 507.
10 copies of Subramanya Bharathiar @ ₹55 each, 15 copies of Thiruvalluvar @ ₹75 each, 12 copies of Veeramamunivar @ ₹60 each and 12 copies of Thiru.Vi.Ka @ ₹70 each.

3. Fill up the appropriate boxes in the following table.

Sl. No	C.P. in ₹	S.P. in ₹	Profit in ₹	Loss in ₹
(i)	100	120		
(ii)	110	120		
(iii)	120		20	
(iv)	100	90		
(v)	120		25	

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4. Fill up the appropriate boxes in the following table.

Sl. No	C.P. in ₹	M.P. in ₹	S.P. in ₹	Discount in ₹	Profit in ₹	Loss in ₹
(i)	110	130		Nil		
(ii)	110	130		10		
(iii)	110	130		30		
(iv)	110	120			Nil	10
(v)		120		10	20	Nil

5. Rani bought a set of bangles for ₹310. Her neighbour liked it most. So, Rani sold it to her for ₹325. Find the profit or loss to Rani.
6. Sugan bought a Jeans pant for ₹750. It did not fit him. He sold it to his friend for ₹710. Find the profit or loss to sugan.
7. Somu bought a second hand bike for ₹28,000 and spent ₹2,000 on its repair. He sold it for ₹30,000. Find his profit or loss.
8. Muthu has a car worth ₹8,50,000 and he wants to sell it at a profit of ₹25,000. What should be the selling price of the car?
9. Valarmathi sold her pearl set for ₹30,000 at profit of ₹5000. Find the cost price of the pearl set.
10. If Guna marks his product to be sold for ₹325 and gives a discount of ₹30, then find the S.P.
11. A man buys a chair for ₹1500. He wants to sell it at a profit of ₹250 after making a discount of ₹100. What is the M.P. of the chair ?
12. Amutha marked her home product of pickle as ₹300 per pack. But she sold it for only ₹275 per pack. What was the discount offered by her per pack ?
13. Valavan bought 24 eggs for ₹96. Four of them were broken and also he had a loss of ₹36 on selling them. What is the selling price of one egg?
14. Mangai bought a cell phone for ₹12585. It fell down. She spent ₹500 on its repair. She sold it for ₹7500. Find her profit or loss.

Objective Type Questions

15. Discount is subtracted from _____ to get S.P.
    (a) M.P. (b) C.P. (c) Loss (d) Profit
16. 'Overhead expenses' is always included in _____.
    (a) S.P. (b) C.P. (c) Profit (d) Loss
17. There is no profit or loss when
    (a) C.P. = S.P. (b) C.P > S.P. (c) C.P < S.P. (d) M.P. = Discount
18. Discount = M.P. – ....
    (a) Profit (b) S.P. (c) Loss (d) C.P.

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Exercise 3.2

Miscellaneous Practice Problems

1. A shopkeeper buys three articles for ₹325, ₹450 and ₹510. He is able to sell them for ₹350, ₹425 and ₹525 respectively. Find the gain or loss to the shopkeeper on the whole.
2. A stationery shop owner bought a scientific calculator for ₹750. He had put a battery worth ₹100 in it. He had spent ₹50 for its outer pouch. He was able to sell it for ₹850. Find his profit or loss.
3. Nathan paid ₹800 and bought 10 bottles of honey from a village vendor. He sold them in a city for ₹100 per bottle. Find his profit or loss.
4. A man bought 400 metre of cloth for ₹60,000 and sold it at the rate of ₹400 per metre. Find his profit or loss.

Challenge Problems

5. A fruit seller bought 2 dozen bananas at ₹20 a dozen and sold them at ₹3 per banana. Find his gain or loss.
6. A store purchased pens at ₹216 per dozen. He paid ₹58 for conveyance and sold the pens at the discount of ₹2 per pen and made a overall profit of ₹50. Find the M.P. of each pen.
7. A vegetable vendor buys 10 kg of tomatoes per day at ₹10 per kg, for the first three days of a week. 1 kg of tomatoes got smashed on everyday for those 3 days. For the remaining 4 days of the week he buys 15 kg of tomatoes daily at ₹8 per kg. If for entire week he sells tomatoes at ₹20 per kg, then find his profit or loss for the week.
8. An electrician buys a used T.V. for ₹12,000 and a used Fridge for ₹11,000. After spending ₹1000 on repairing the T.V. and ₹1500 on painting the Fridge, he fixes up the M.P. of T.V. as ₹15,000 and that of Fridge as ₹15,500. If he gives ₹1000 discount on each find his profit or loss.

Summary

- Every bill of a purchase of goods contains the name of the shop from which the goods are purchased, the serial number, the date, the number of items, the rate, the amount of each item and the total amount of the bill etc.
- Selling Price (S.P.) is the price at which an item is sold.
- Profit is the difference between S.P. and C.P., when S.P. > C.P.
- Loss is the difference between C.P and S.P, when C.P. > S.P.
- Discount = M.P. – S.P. ⇒ S.P. = M.P. – Discount.

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CHAPTER 4

GEOMETRY

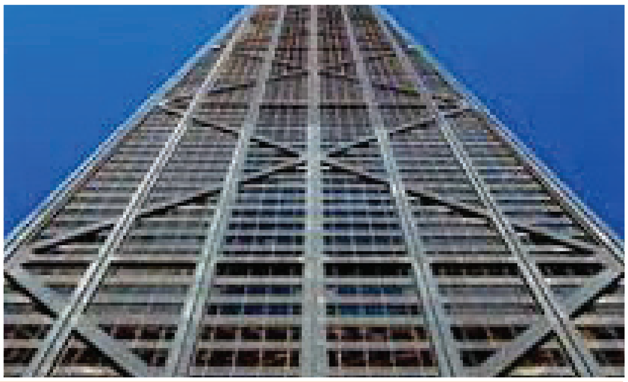
Learning Objectives

- To understand the formation of triangles and the basic elements of a triangle.
- To know the types of triangles and their properties.
- To draw parallel and perpendicular lines using a set square.

4.1 Introduction

We already studied the basic geometrical concepts such as angles and its types, drawing line segments, drawing and measuring angles in the first term. In this term, we will study triangles and their types, construction of parallel and perpendicular lines to a given line segment.

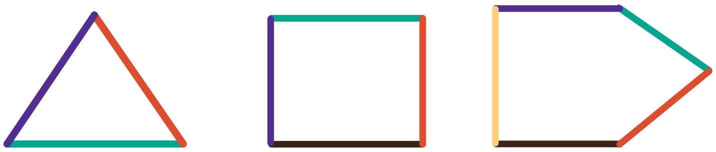
MATHEMATICS ALIVE – TRIANGLES IN REAL LIFE



The triangle is used in most types of construction work including bridges, buildings, cell-phone towers, aeroplane wings and pitched roofs. Its use in construction gives an object the quality of stiffness, resulting in rigid and strong structures.

Think about the situation:

A teacher distributes 2, 3, 4 and 5 sticks of equal lengths to four students and asks them to form a closed figure. Three students make the following figures.



But one of the students who has 2 sticks with him creates the following figure.

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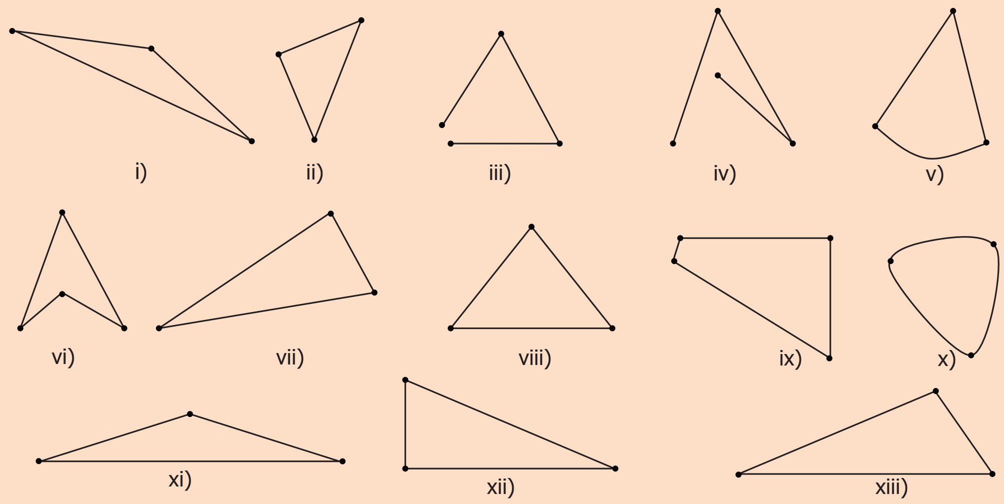
He is not able to create a closed figure. Do you know why? Can you guess the least number of sticks required to form a closed figure? Three sticks. If you had formed a closed figure with three sticks, then what shape would you get? Is there any special name for it? Yes. Its ***triangle.***

A closed figure formed by three line segments is called a triangle.

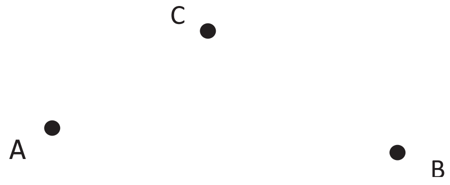
Activity

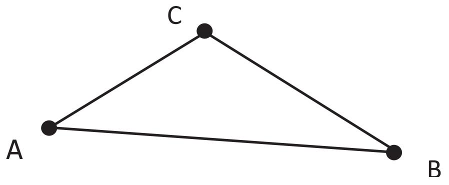
Classify the given shapes into triangles and non triangles.



4.2 Basic Elements of a Triangle

Mark 3 points A, B, C on a paper, such that they do not lie on a same straight line. Consider the line segments AB, BC and CA.



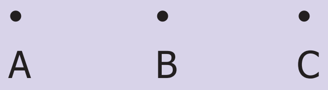


We see that they form a ***triangle ABC*** which is represented as ***∆ ABC or ∆BCA or ∆CAB.***

In ∆ ABC, the line segments **AB, BC** and **CA** are called the ***sides of the triangle*** and **∠CAB, ∠ABC** and **∠BCA (∠A, ∠B & ∠C)** are called the ***angles of the triangle.*** The point of intersection of two sides of the triangle is called the ***vertex.*** **A, B** and **C** are ***three vertices of ∆ ABC.*** Hence, ***a triangle has 3 sides, 3 angles and 3 vertices.***

Think

Can a triangle be drawn using 3 points on a straight line?



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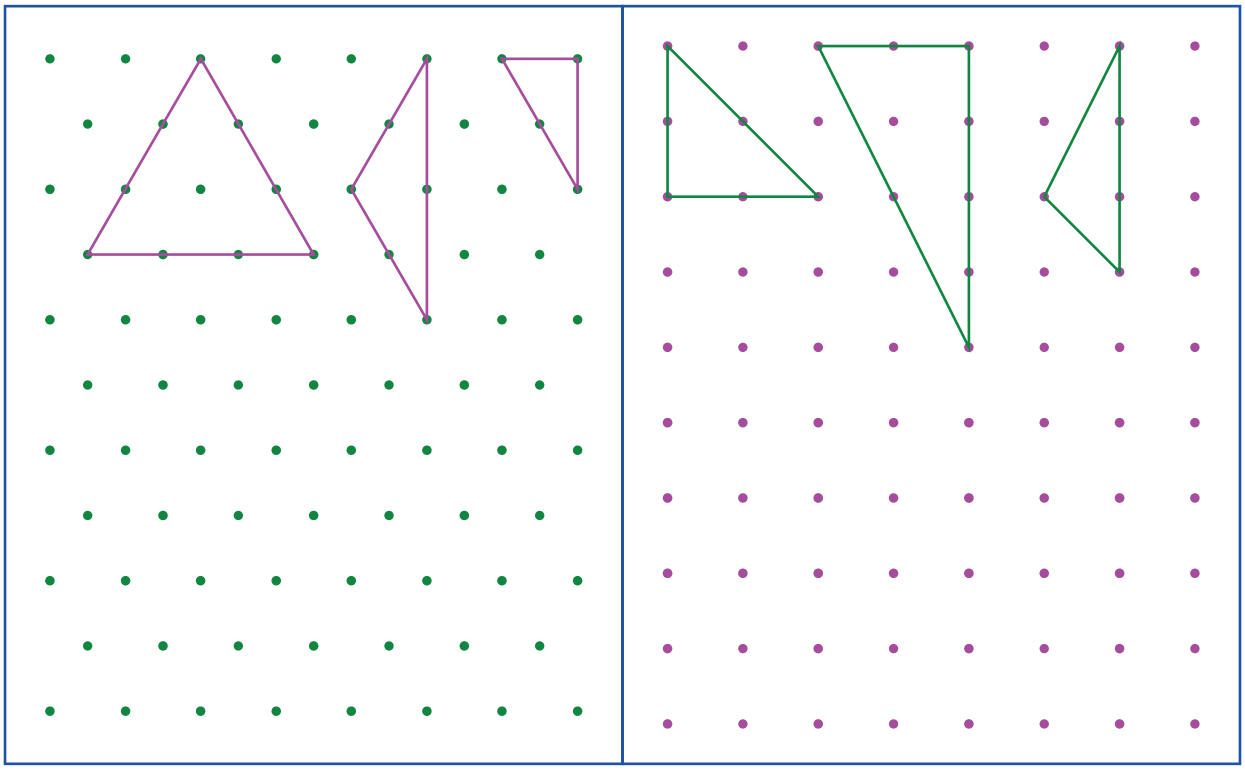
4.3 Types and Properties of Triangles

Some triangles are drawn in the dotted sheet. Try to draw as many triangles as you can. Then, measure the sides and angles of all triangles and fill the table given below



S. No	Measure of angles	Sum of the measure of angles	Nature of angles	Measure of sides	Nature of Sides
1	60° , 60°, 60°	180°	Three angles are equal	3 cm, 3 cm, 3cm	Three sides are equal

From the table, we observe the following:

In a triangle,

- If the measure of all angles are different, then all sides are different.
- If the measure of two angles are equal, then two sides are equal.
- If the measure of three angles are equal, then three sides are equal and each angle measures 60°.
- Sum of three angles of a triangle is 180°.

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Activity

Students are divided into groups and each group is given 3 sticks of length 9 units, 2 sticks of length 3 units, 2 sticks of length 2 units, 1 stick of length 5 units and 1 stick of length 4 units. Using the given sticks they are asked to form three triangles, find the length of the sides of each triangle and tabulate them.

Triangle	Length of side 1	Length of side 2	Length of side 3	All sides are equal / 2 sides are equal / 3 sides are different
1				
2				
3				

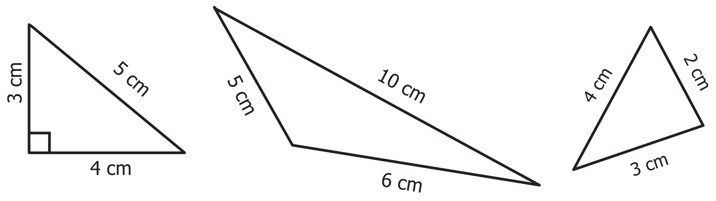
Read the table and answer the following questions.

1. Was each group able to form 3 triangles?
2. In each of the triangle formed, how many sides are equal?

4.3.1 Types of triangle based on its sides

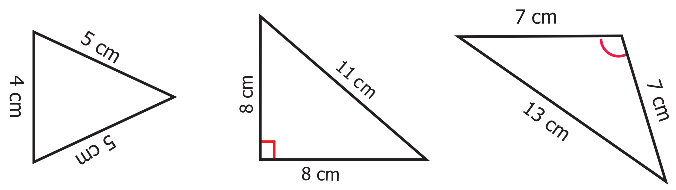
i) If three sides of a triangle are different in lengths, then it is called a ***Scalene Triangle***

Examples:



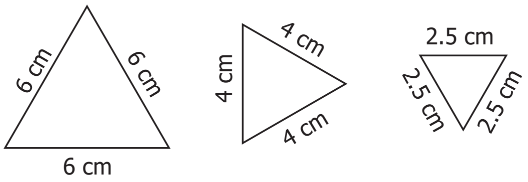
ii) If any two sides of a triangle are equal in length, then it is called an ***Isosceles Triangle***

Examples:



iii) If three sides of a triangle are equal in length, then it is called an ***Equilateral Triangle***

Examples:



Thus, based on the sides of triangles, we can classify triangles into 3 types.

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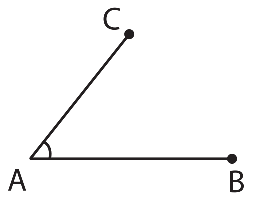
Try these

Complete the following table. In any triangle,

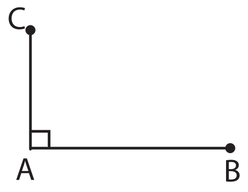
Sl. No	Side 1	Side 2	Side 3	Type of Triangle
1.	6cm	7cm	8cm	Scalene Triangle
2.	5cm	5cm	5cm	
3.	2.2cm	2.5cm	3.2cm	
4.	7cm	7cm	10cm	
5.	10cm	10cm	10cm	
6.	10cm	8cm	8cm	

4.3.2 Types of triangle based on its angles

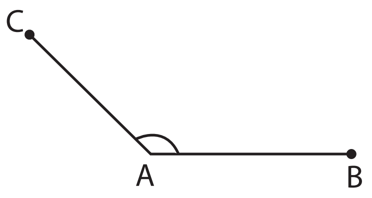
Write the given angles as acute, obtuse or right angle formed by two line segments AB and AC



∠A is ______________

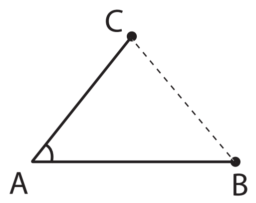


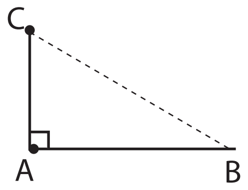
∠A is ______________

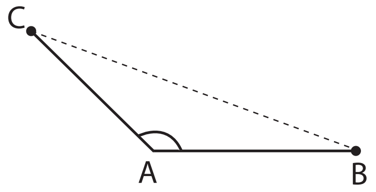


∠A is ______________

Now, join the third side to form a triangle in each case and identify the kinds of angles and list them down.







∠A is ______________ ∠A is ______________ ∠A is ______________

∠B is ______________ ∠B is ______________ ∠B is ______________

∠C is ______________ ∠C is ______________ ∠C is ______________

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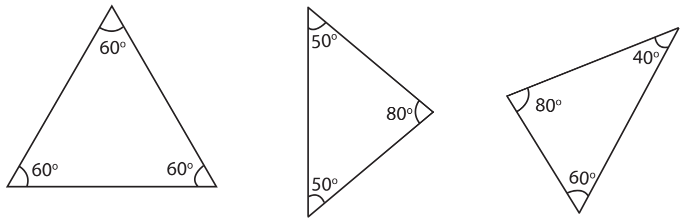
Now carefully look at these three triangles,

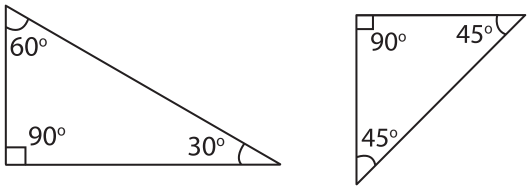
i) If three angles of a triangle are acute angles (between 0° and 90°), then it is called an ***Acute Angled Triangle.***

Examples:



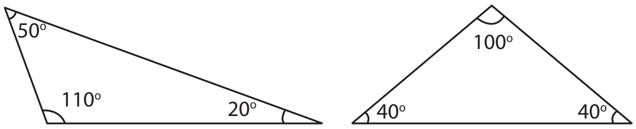
ii) If an angle of a triangle is a right angle (90°), then it is called a ***Right Angled Triangle.***

Examples:



iii) If an angle of a triangle is an obtuse angle (between 90° and 180°),then it is called an ***Obtuse Angled Triangle.***

Examples:



Thus, based on the angles of triangles, we can classify triangles into 3 types.

Try these

Complete the table

S.No.	∠ A	∠ B	∠ C	Sum of three angles	Can a ΔABC be formed?	Type of Triangle
1	60°	60°	60°	180°	Yes	Acute angled triangle
2	50°	40°	90°			
3	60°	30°	90°			
4	95°	40°	35°			
5	110°	40°	30°			
6	150°	60°	70°			

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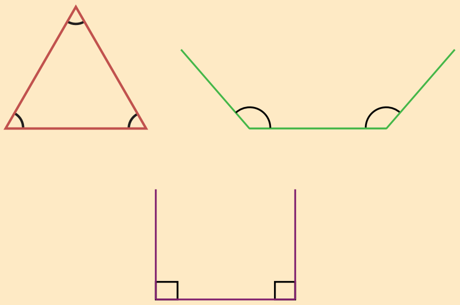
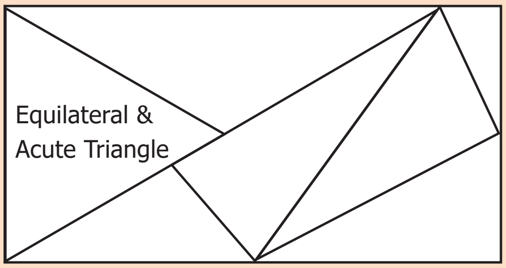
DO YOU KNOW?

A triangle can have three acute angles, but cannot have more than one right angle or an obtuse angle.



Activity

In the given figure, there are some triangles. Measure their sides and angles and name them in two ways. (One is done for you!)



4.3.3 Triangle Inequality property

Think about the situation:

Three students Kamala, Madhan and Sumathi are asked to form triangles with the given sticks of measure **6cm, 8cm, 5cm; 4cm, 10cm, 5cm** and **10cm, 6cm, 4cm** respectively. All of them try to form a triangle. While Kamala, the first girl is successful in forming a triangle, Madhan and Sumathi, next to Kamala are struggling. Why?

When they are trying to join the ends of the two smaller sticks, they find that the two smaller sticks coincide with the longer stick or shorter than the longer stick and they are unable to form triangles. From this, they understand that,

To form a triangle the sum of two smaller sides must be greater than the third side. Thus,

In a triangle, the sum of any two sides is greater than the third side. This is known as ***Triangle Inequality*** property.

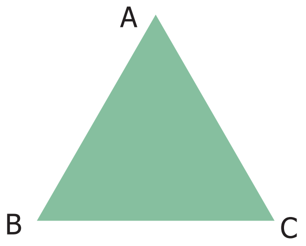
Note

If three sides are equal in length, then definitely a triangle can be formed

AB + BC > CA

BC + CA > AB

CA + AB > BC



DO YOU KNOW?

If any two sides of the triangle are given, then the length of the third side will lie between the difference and sum of the lengths of two given sides.

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Example 1: Can a triangle be formed with 7 cm, 10 cm and 5 cm as its sides?

Solution: Instead of checking triangle inequality by all the sides in the triangle, check only with two smaller sides.

Sum of two smaller sides of the triangle = 5+7=12 cm > 10 cm, the third side.

It is greater than the third side.

So, a triangle can be formed with the given sides.

Example 2: Can a triangle be formed with 7 cm, 7 cm and 7 cm as its sides?

Solution: If three sides are equal, then definitely a triangle can be formed, as the triangle inequality is satisfied.

Example 3: Can a triangle be formed with 8 cm, 3 cm and 4 cm as its sides?

Solution: The sum of two smaller sides = 3+4=7 cm <8 cm, the third side.

It is less than the third side.

So, a triangle cannot be formed with the given sides.

Try these

Can a triangle be formed with the given sides? If yes, state the type of triangle formed.

S.No.	$\overline{AB}$	$\overline{BC}$	$\overline{CA}$	Can a ΔABC be formed?	Type of triangle
1	7 cm	10 cm	6 cm		
2	10 cm	8 cm	8 cm		
3	8.5 m	7.3 m	6.8 m		
4	4 cm	5 cm	12 cm		
5	15 m	20 m	20 m		
6	23 cm	20 cm	18 cm		
7	3.2 cm	1.5 cm	1.5 cm		

Example 4: Can a triangle be formed with the angles 80°, 30°, 40°?

Solution: In a triangle, the sum of three angles is 180°.

Here, the sum of three angles = 80°+ 30°+ 40° = 150° **(not equal to 180°)**

So, a triangle cannot be formed with the given angles.

Think

Can the difference between two larger sides be less than the third side?

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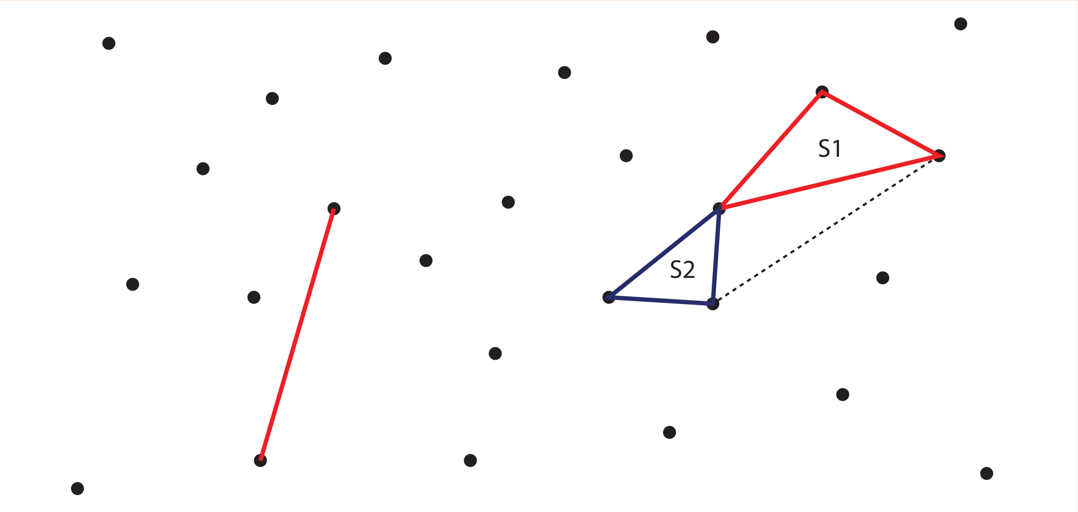
Activity

A triangle game : In each turn a student must draw one line connecting two dots. A line should not cross other lines or touch other dots than the two that are connected to. If a student closes a triangle with his line then he gets a point. Once there are no more lines that can be drawn the game is over and the student who gains more points wins the game.



Think

In a right angled triangle, what measures can the other two angles have?

Exercise 4.1

1. Fill in the blanks:

a) Every triangle has at least _______ acute angles.

b) A triangle in which none of the sides are equal is called a _______.

c) In an isosceles triangle ________angles are equal.

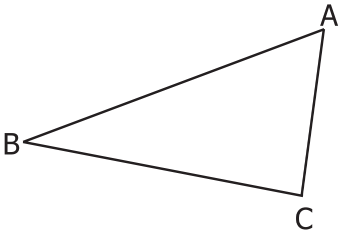
d) The sum of three angles of a triangle is _______.

e) A right angled triangle with two equal sides is called ________.

2. Match the following:

(i) No sides are equal	-	Isosceles triangle
(ii) One right angle	-	Scalene triangle
(iii) One obtuse angle	-	Right angled triangle
(iv) Two sides of equal length	-	Equilateral triangle
(v) All sides are equal	-	Obtuse angled triangle

3. In ΔABC, name the



a) Three sides: _______ , _______ , ________

b) Three Angles: _______ , _______ , ________

c) Three Vertices: _______ , ________ , ________

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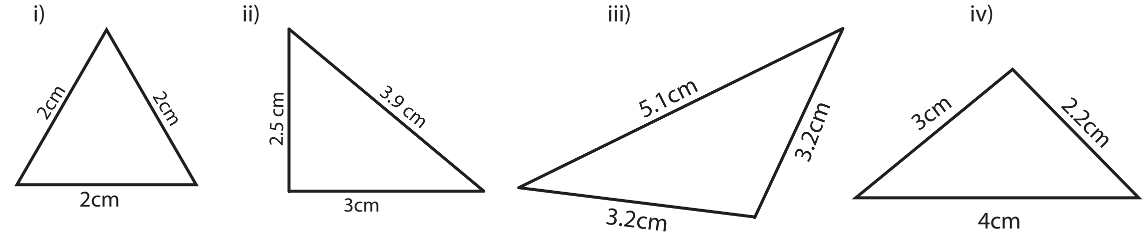
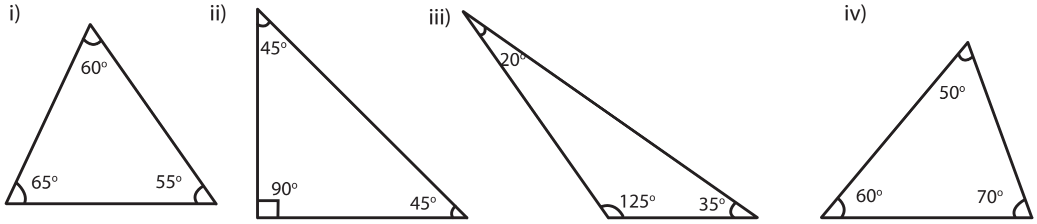
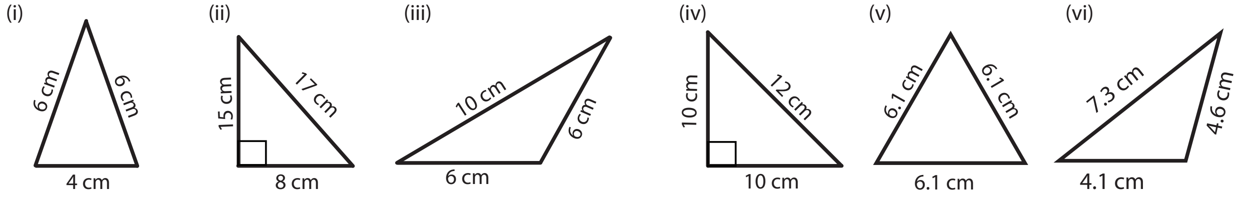
4. Classify the given triangles based on its sides as scalene, isosceles or equilateral.



5. Classify the given triangles based on its angles as acute angled, right angled or obtuse angled.



6. Classify the following triangles based on its sides and angles.



7. Can a triangle be formed with the following sides? If yes, name the type of triangle.

(i) 8 cm, 6 cm, 4 cm
(ii) 10 cm, 8 cm, 5 cm
(iii) 6.2 cm, 1.3 cm, 3.5 cm
(iv) 6 cm, 6 cm, 4 cm
(v) 3.5 cm, 3.5 cm, 3.5 cm
(vi) 9 cm, 4 cm, 5 cm

8. Can a triangle be formed with the following angles? If yes, name the type of triangle.

(i) 60°, 60°, 60°
(ii) 90°, 55°, 35°
(iii) 60°, 40°, 42°
(iv) 60°, 90°, 90°
(v) 70°, 60°, 50°
(vi) 100°, 50°, 30°

9. Two angles of the triangles are given. Find the third angle.

(i) 80°, 60°
(ii) 75°, 35°
(iii) 52°, 68°
(iv) 50°, 90°
(v) 120°, 30°
(vi) 55°, 85°

10. I am a closed figure with each of my three angles is 60°. Who am I?

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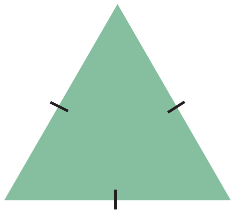
11. Using the given information, write the type of triangle in the table given below

S.No.	∠1	∠2	∠3	Type of triangle based on angles	Type of triangle based on sides
i.	60°	40°	80°	Acute angled triangle.	Scalene Triangle
ii.	50°	50°	80°		
iii.	45°	45°	90°		
iv.	55°	45°	80°		
v.	75°	35°	70°		
vi.	60°	30°	90°		
vii.	25°	64°	91°		
viii.	120°	30°	30°		

Objective Type Questions

12. The given triangle is________.



a) a right angled triangle b) an equilateral triangle

c) a scalene triangle d) an obtuse angled triangle

13. If all angles of a triangle are less than a right angle, then it is called ________.

a) an obtuse angled triangle b) a right angled triangle

c) an isosceles right angled triangle d) an acute angled triangle

14. If two sides of a triangle are 5 cm and 9 cm, then the third side is_______.

a) 5 cm b) 3 cm c) 4 cm d) 14 cm

15. The angles of a right angled triangle are

a) acute, acute, obtuse b) acute, right, right

c) right, obtuse, acute d) acute, acute, right

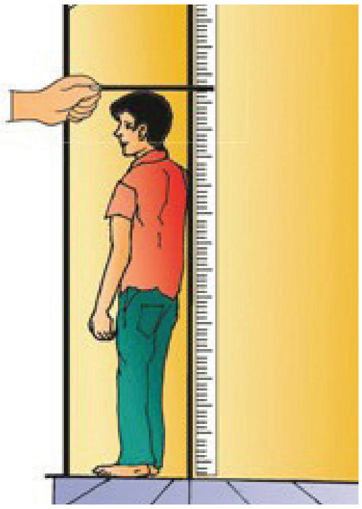
16. An equilateral triangle is

a) an obtuse angled triangle b) a right angled triangle

c) an acute angled triangle d) a scalene triangle

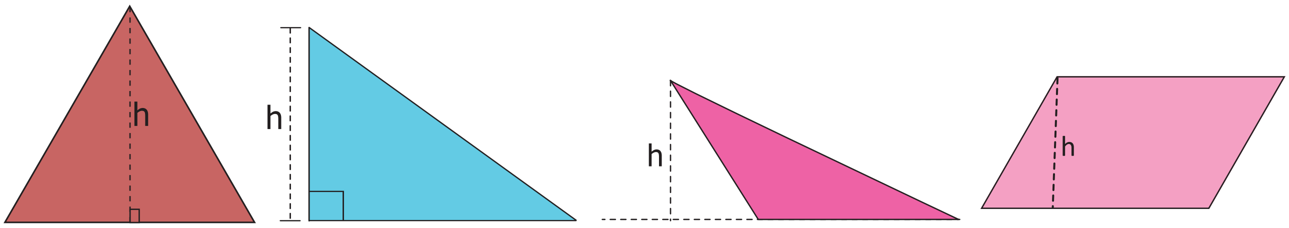
4.4 Construction of Perpendicular Lines

4.4.1 Introduction



Have you ever noticed that the wall and floor are always perpendicular to each other? So, to measure our heights, we make use of scale represented on the walls as shown in the figure.

In Geometry, to measure the height of figures, we use perpendicular lines .Using a set square, find the height of the given figures.



h=_____cm h=_____cm h=_____cm h=_____cm

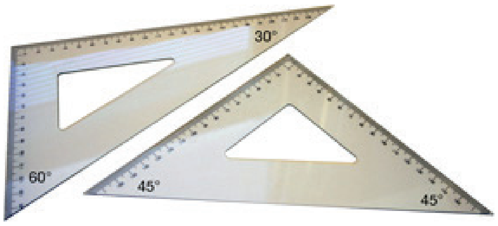
Let us learn to construct perpendicular lines by using set square.

4.4.2 Set Squares

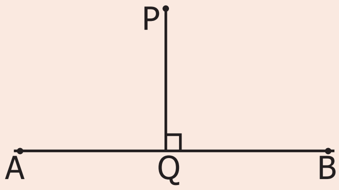
The set squares are two triangle shaped instruments in the Geometry Box. Each of them has a right angle. One set square has the angles 30°, 60°, 90° and the other set square has the angles 45°, 45°, 90°. The perpendicular edges are graduated in centimetres.

Set squares have several uses:

- To construct the specific angles 30°, 45°, 60°, 90°
- To draw parallel and perpendicular lines
- To measure the height of the shapes



DO YOU KNOW?



If the perpendicular from P meets AB at Q, the point Q is called the foot of the perpendicular from P to AB and the symbol "⊥" means "is perpendicular to". i.e., PQ ⊥ AB

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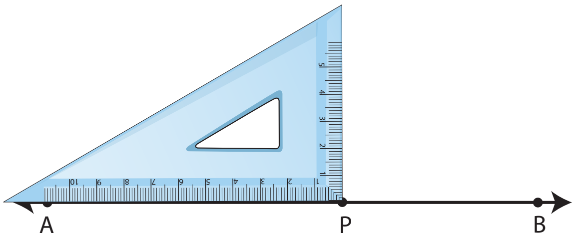
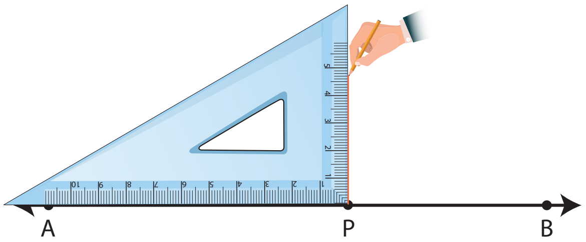
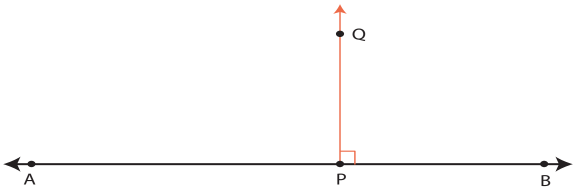
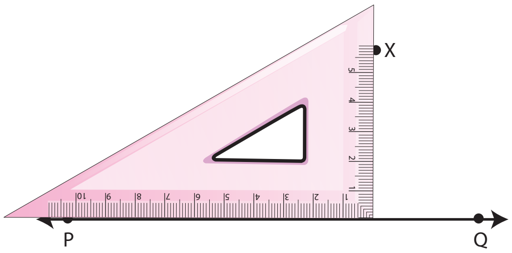
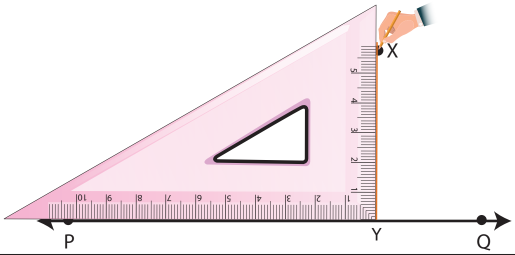
Example 5: Construct a line perpendicular to the given line at a point on the line.

Step 1: Draw a line AB and take a point P anywhere on the line.	
Step 2: Place the set square on the line in such a way that the vertex which forms right angle coincides with P and one arm of the right angle coincides with the line AB.	
Step 3: Draw a line PQ through P along the other arm of the right angle of the set square.	
Step 4: The line PQ is perpendicular to the line AB at P. That is, $PQ \perp AB$ and $\angle APQ = \angle BPQ = 90^\circ$.	

Example 6: Construct a line perpendicular to the given line through a point above it.

Step 1: Draw a line PQ. Take a point X anywhere above the line PQ.	
Step 2: Place one of the arms of the right angle of a set square along the line PQ and the other arm of its right angle touches the point X.	
Step 3: Draw a line through the point X meeting PQ at Y.	
Step 4: The line XY is perpendicular to the line PQ at Y. That is, $XY \perp PQ$	

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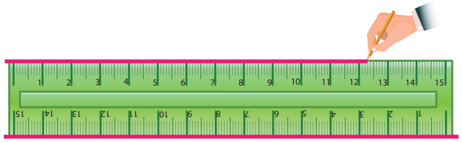
4.5 Construction of Parallel Lines

Place a scale on a paper and draw lines along both the edges of the scale as shown.



Place the set square at two different points on ℓ_1 and find the perpendicular distance between ℓ_1 and ℓ_2. Are they equal? Yes. Thus, the perpendicular distance between a set of parallel lines remains the same.

Note

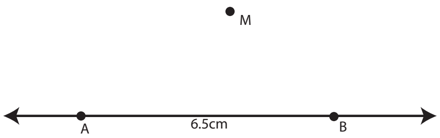
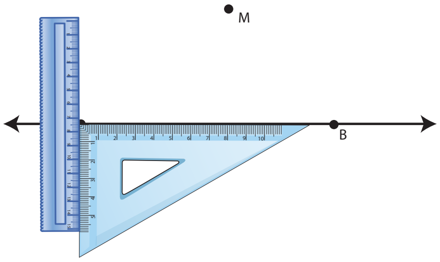
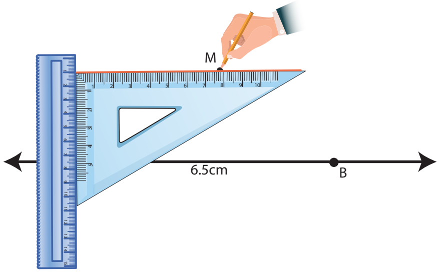
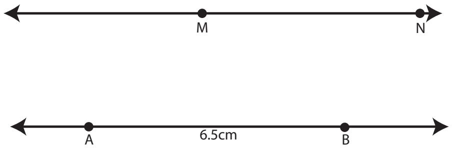
Parallel line segments need not be of equal length

Think

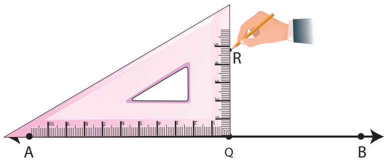
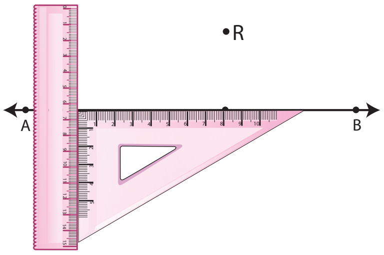
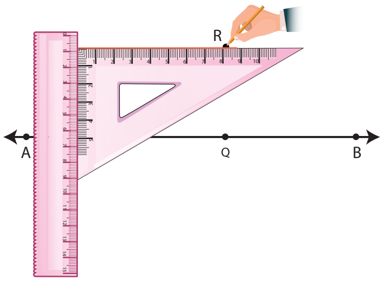
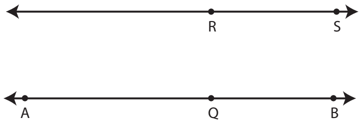
Identify the parallel lines in English alphabets (Capital Letters) and list the letters.

Examples: E W

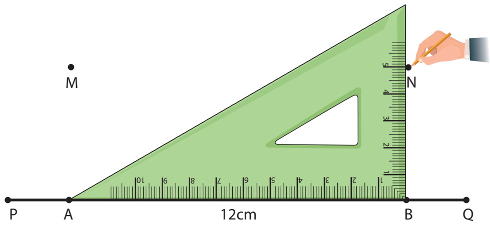
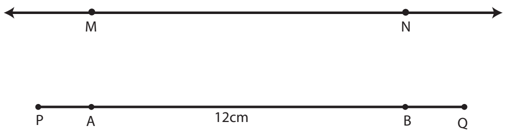
Example 7: Draw a line segment AB = 6.5 cm and mark a point M above it. Through M draw a line parallel to AB.

Step 1: Draw a line. Mark two points A and B on the line such that AB = 6.5 cm. Mark a point M anywhere above the line.	
Step 2: Place the set square below AB in such a way that one of the edges that forms a right angle lies along AB. Place the scale along the other edge of the set square as shown in the figure.	
Step 3: Holding the scale firmly, Slide the set square along the edge of the scale until the other edge of the set square reaches the point M. Through M draw a line as shown.	
Step 4: The line MN is parallel to AB. That is, MN ∥ AB	

Example 8: Draw a line and mark a point R at a distance of 4.8 cm above the line. Through R draw a line parallel to the given line.

Step 1: Using a scale draw a line AB and mark a point Q on the line.	
Step 2: Place the set square in such a way that the vertex of the right angle coincides with Q and one of the edges of right angle lies along AB. Mark the point R such that QR = 4.8 cm.	
Step 3: Place the scale and the set square as shown in the figure.	
Step 4: Hold the scale firmly and slide the set square along the edge of the scale until the other edge touches the point R. Draw a line RS through R.	
Step 5: The line RS is parallel to AB. That is, RS ǁ AB.	

Example 9: Draw a line segment PQ = 12 cm. Mark two points M, N at a distance of 5 cm above the line segment PQ. Through M and N draw a line parallel to PQ.

Step 1: Using a scale, draw a line segment PQ = 12 cm. Mark two points A and B on the line segment.	
Step 2: Using the set square as shown, mark points M and N such that AM = BN = 5 cm.	
Step 3: Using the scale, join M and N. MN is parallel to PQ. That is, MN ǁ PQ.	

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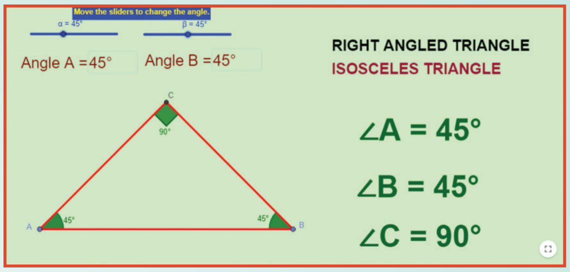
GEOMETRY

ICT CORNER

Expected Outcome



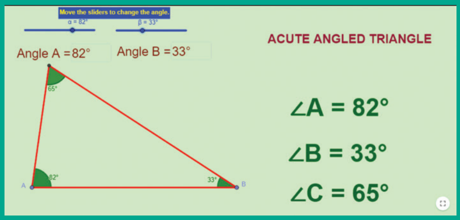
Step 1

Open the Browser and type the URL Link given below (or) Scan the QR Code. GeoGebra work sheet named "Geometry" will open. The work sheet contains three activities. 1. Types of triangles, 2. Perpendicular line construction and 3. Parallel line construction.

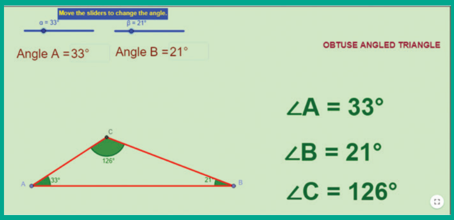
In the first activity move the sliders or enter the angle to change the Angles of the triangle and check what type of triangle is it and compare with the angles.

Step 2

In the second and third activity you can learn how to draw Perpendicular and parallel lines through a Video.



Step1



Step1

Browse in the link:

Geometry: https://ggbm.at/dPXHSSTF or Scan the QR Code.

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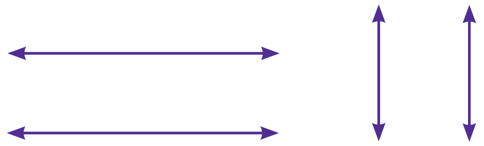
Exercise 4.2

1. Draw a line segment AB = 7 cm and mark a point P on it. Draw a line perpendicular to the given line segment at P.
2. Draw a line segment LM = 6.5 cm and take a point P not lying on it. Using a set square construct a line perpendicular to LM through P.
3. Find the distance between the given lines using a set square at two different points on each of the pairs of lines and check whether they are parallel.

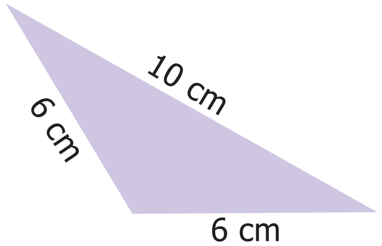


4. Draw a line segment measuring 7.8 cm. Mark a point B above it at a distance of 5 cm. Through B draw a line parallel to the given line segment.
5. Draw a line and mark a point R below it at a distance of 5.4 cm Through R draw a line parallel to the given line.

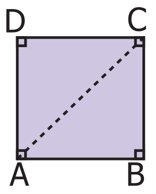
Exercise 4.3

Miscellaneous Practice Problems

1. What are the angles of an isosceles right angled triangle?
2. Which of the following correctly describes the given triangle?
   (a) It is a right isosceles triangle.
   (b) It is an acute isosceles triangle.
   (c) It is an obtuse isosceles triangle.
   (d) It is an obtuse scalene triangle.



3. Which of the following is not possible?
   (a) An obtuse isosceles triangle (b) An acute isosceles triangle
   (c) An obtuse equilateral triangle (d) An acute equilateral triangle
4. If one angle of an isosceles triangle is 124°, then find the other angles.
5. The diagram shows a square ABCD. If the line segment joins A and C, then mention the type of triangles so formed.



6. Draw a line segment AB of length 6 cm. At each end of this line segment AB, draw a line perpendicular to the line AB. Are these lines parallel?

Challenge Problems

7. Is a triangle possible with the angles 90°, 90° and 0°? Why?
8. Which of the following statements is true? Why?
   (a) Every equilateral triangle is an isosceles triangle.
   (b) Every isosceles triangle is an equilateral triangle.

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9. If one angle of an isosceles triangle is 70°, then find the possibilities for the other two angles.

10. Which of the following can be the sides of an isosceles triangle?

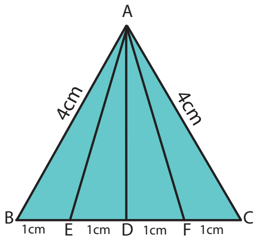
a) 6cm, 3cm, 3cm b) 5cm, 2cm, 2cm c) 6cm, 6cm, 7cm d) 4cm, 4cm, 8cm

11. Study the given figure and identify the following triangles.

(a) equilateral triangle (b) isosceles triangles

(c) scalene triangles (d) acute triangles

(e) obtuse triangles (f) right triangles



12. Two sides of the triangle are given in the table. Find the third side of the triangle.

Sl. No.	Side - 1	Side - 2	The length of the third side (any three measures)
i.	7 cm	4 cm	
ii.	8 cm	8 cm	
iii.	7.5 cm	3.5 cm	
iv.	10 cm	14 cm	

13. Complete the following table:

Types of Triangle / Its Angles	Acute angled triangle	Right angled triangle	Obtuse angled triangle
Any two angles	Always acute angles	i.	Always acute angles
Third angle	ii.	Right angle	iii.

Summary

- A closed figure formed by three line segments is called a triangle.
- A triangle has 3 sides, 3 angles and 3 vertices.
- Based on the sides of triangles, we can classify triangles into 3 types as scalene triangle, isosceles triangle and equilateral triangle.
- Based on the angles of triangles, we can classify triangles into 3 types as acute angled triangle, right angled triangle and obtuse angled triangle.
- In a triangle, the sum of any two sides is greater than the third side. This is known as Triangle Inequality property.
- Sum of three angles of a triangle is 180°.
- Parallel and Perperndicular lines can easily be drawn using set squares.
- The distance between a set of parallel lines always remains the same.

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CHAPTER 5

INFORMATION PROCESSING

HKFN4

Learning Objectives

- To know how to represent numerical and algebraic expressions by tree diagrams.
- To know how to write numerical and algebraic expressions from tree diagrams.

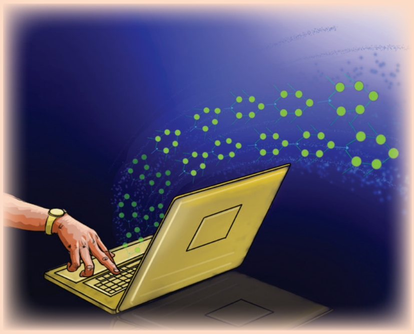
5.1 Introduction

In today's digital era, it is almost impossible to imagine a day without computers. Right from small shops to big software companies, the use of computers is inevitable. If there are no computers, most of the works will be stopped. Computers are able to find solutions even for complicated numerical expression and algebraic expression in quick and easy way. The answer given by the computer will be very precise and need not to be recalculated. There will be a question, how the computer read these expression?

Yes, Computers use **Tree diagram** to perform billions of operations in a uniform way and gives the answer. In this chapter we will learn about the **Tree diagram for both numeric and algebraic expressions**.

MATHEMATICS ALIVE – INFORMATION PROCESSING IN REAL LIFE

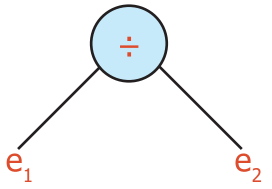
Information process in the Human Brain



Information process in computer

Consider the numerical expression $[(9-4)\times 8] \div [(8+2)\times 3]$. We can try to understand the expression in a better way through the tree diagram.

1) Let us consider $e_1 = (9-4)\times 8$, $e_2 = (8+2)\times 3$ we get



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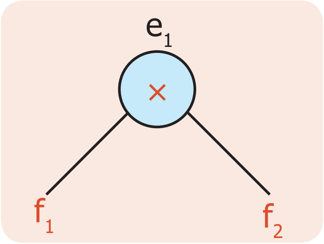
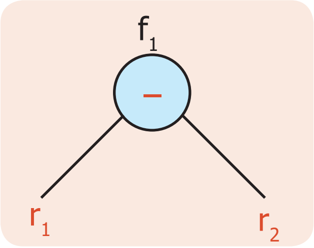
2) $e_1 = f_1 \times f_2$

Where, $f_1 = 9 - 4$ and $f_2 = 8$



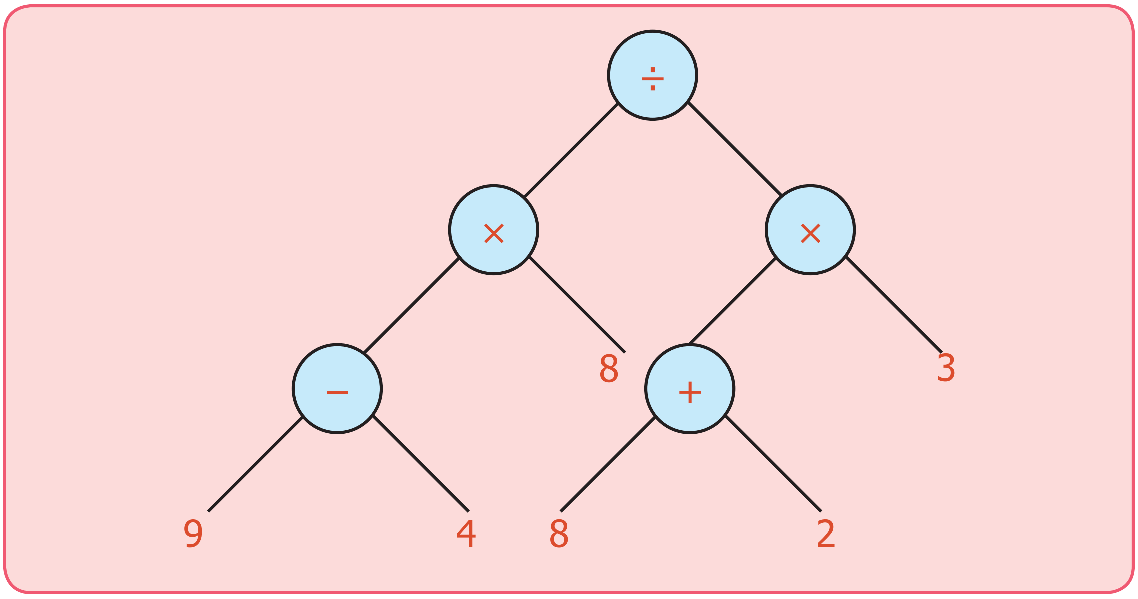
3) $f_1 = r_1 - r_2$ where $r_1 = 9$ and $r_2 = 4$.

f_1 is represented as:



Similarly, the trees can be developed from e_2.

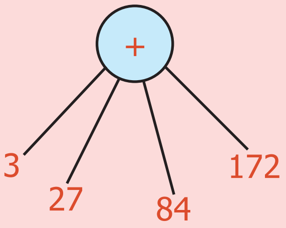
4) Putting all together, we get the following tree diagram



It is a picture which look like an upside-down tree! Every node has one or two branches. And the leaves are numbers. The branching nodes have operations on them. It is called **tree diagram** and the tree diagrams are general ways of representing arithmetical expressions. Here trees are drawn upside down.

The root is at the top, the leaves are at the bottom. Since all the arithmetical operations are binary (Involving two numbers) we have only 2 way branching in the tree.

Can you represent the addition of four numbers in the same way?
Yes, there is a way for addition of 4 numbers.



Let us learn how to represent the statement problems in tree diagram

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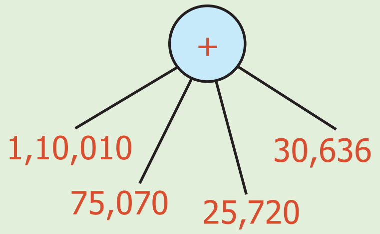
Example 1: In the flower exhibition conducted at Ooty for 4 days the number of tickets sold on the first, second, third and fourth days are 1,10,010; 75,070; 25,720 and 30,636 respectively. Find the total number of tickets sold.

Solution:

Number of tickets sold on the first day	=	1,10,010
Number of tickets sold on the second day	=	75,070
Number of tickets sold on the third day	=	25,720
Number of tickets sold on the fourth day	=	30,636
Total	=	2,41,436
Total number of tickets sold	**=**	**2,41,436**

Tree Diagram

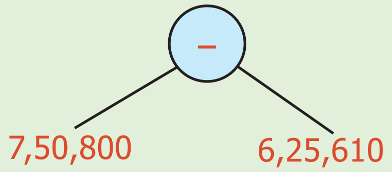


Example 2: In one year, a paper company had sold 6,25,610 notebooks out of a stock of 7,50,800 notebooks. Find the number of notebooks left unsold.

Solution:

Number of Notebooks in stock	=	7,50,800
Number of Notebooks sold	=	6,25,610
Number of notebooks left unsold	**=**	**1,25,190**

Tree Diagram



Example 3: Vani and Kala along with three other friends went to a butter milk shop. The cost of one butter milk is ₹ 6. If 9 more friends joined them, then how much money did they have to pay? Vani said they had to pay ₹ 84 whereas Kala said they had to pay ₹ 59. Who is correct?

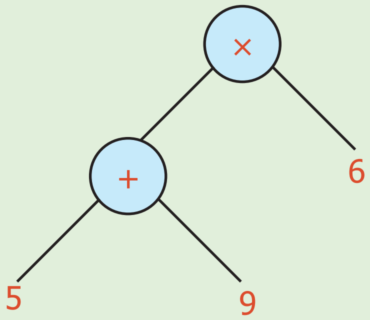
Solution:

This confusion can be resolved by using the brackets in the correct places like (5+9)×6.

It is further clear from the tree diagram.

Therefore Vani is correct

Tree Diagram of (5+9)×6



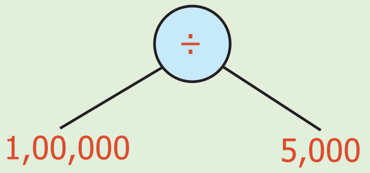
Example 4: If a ration shop has distributed 1,00,000 kg of rice to 5000 families, then find the quantity of rice given to each family?

Solution:

Quantity of rice to be distributed to 5000 families	=1,00,000 kg
Quantity of rice distributed to each family	=1,00,000÷5,000
	=20 kg

Each family was given 20 kg of rice.

Tree Diagram



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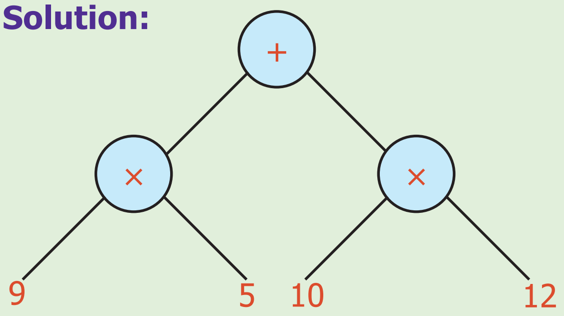
Example 5: Convert into a Tree diagram

(9×5)+(10×12)

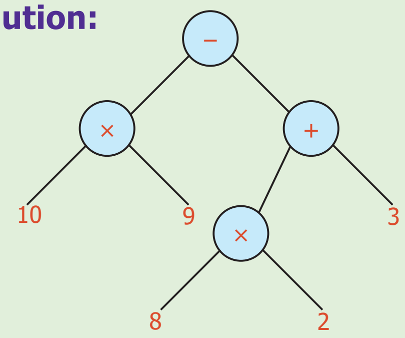
Solution:



Example 6: Convert into a Tree diagram

(10×9)−[(8×2)+3]

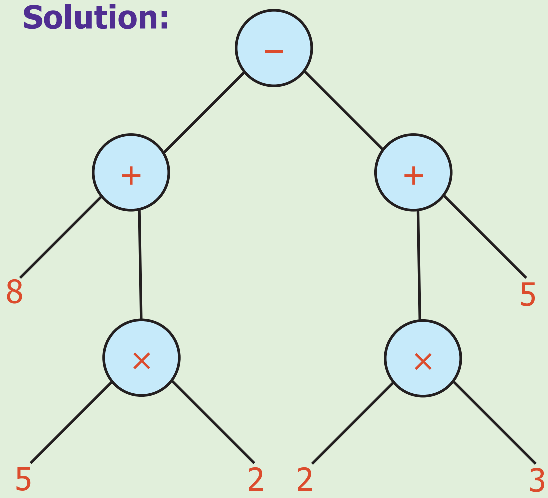
Solution:



Example 7: Convert into a Tree diagram

[8+(5×2)]−[(2×3)+5]

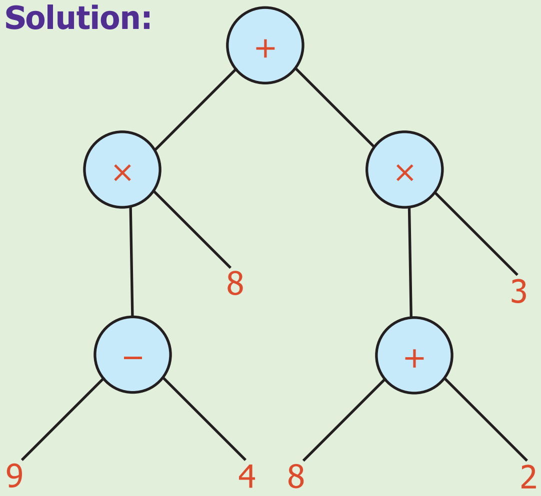
Solution:



Example 8: Convert into a Tree diagram

[(9−4)×8]+[(8+2)×3]

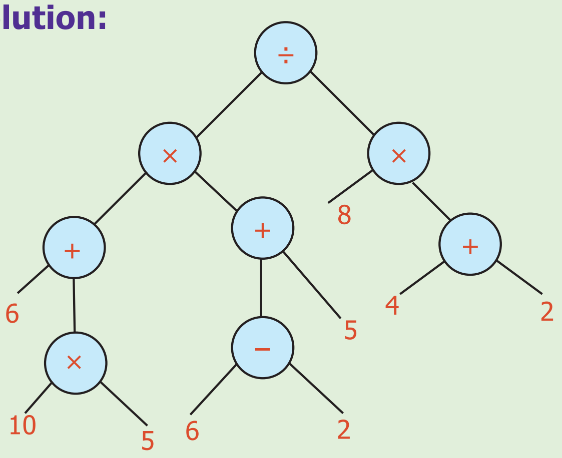
Solution:



Example 9: Convert into a Tree diagram

{[(10×5)+6]×[5+(6−2)]}÷[8×(4+2)]

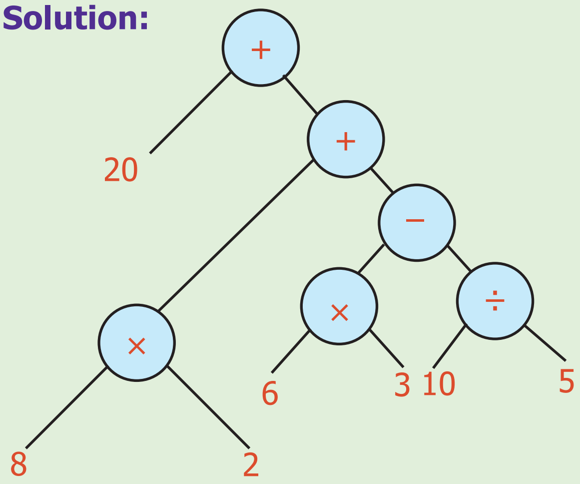
Solution:



Example 10: Convert into a Tree diagram

20+[8×2+{(6×3)−10÷5}]

Solution:



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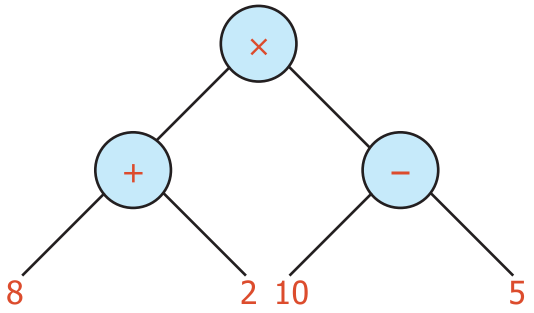
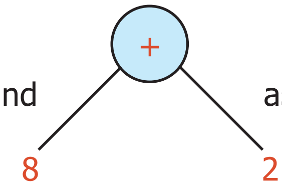
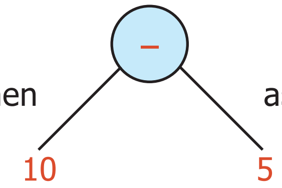
5.2 Conversion of Tree Diagrams into Numerical Expressions

For instance, consider the tree

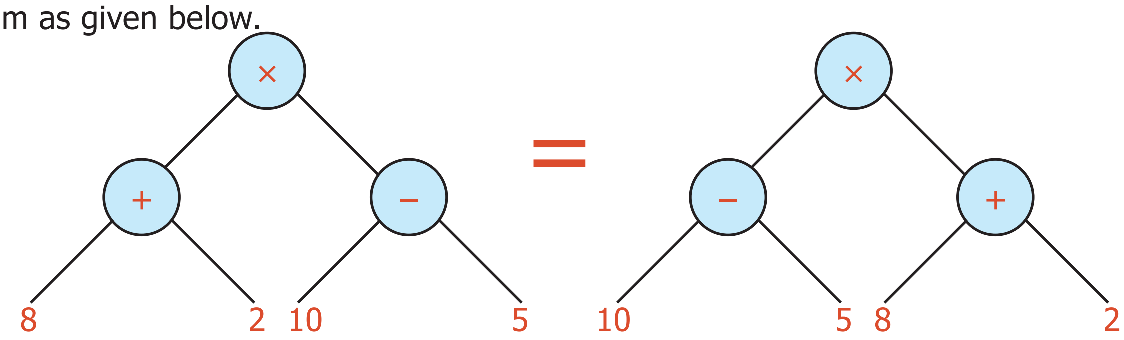


We could first find 

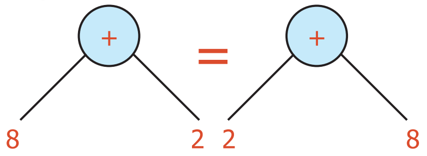
as 10, then 

as 5

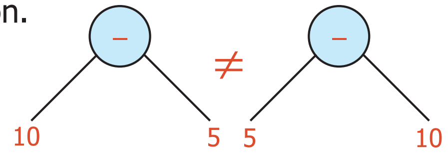
When we multiply the results 10 and 5 we get 50. When the nodes for addition and subtraction are interchanged the value remains the same which is represented using tree diagram as given below.



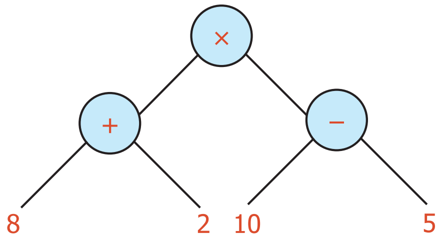
Does it mean that the branches also can be interchanged? Yes, when the node represents addition it is possible.



But it is not possible when the node represents subtraction.

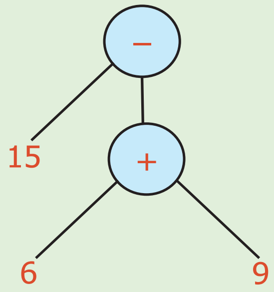


Therefore from this tree diagram.



Example 11: Convert the tree diagram into numerical expression.

Tree diagram



Numerical Expression

15−(6+9)

The expression can be converted into either (10−5)×(8+2) or (8+2)×(10−5) or (2+8)×(10−5) or (10−5)×(2+8) without changing the value.

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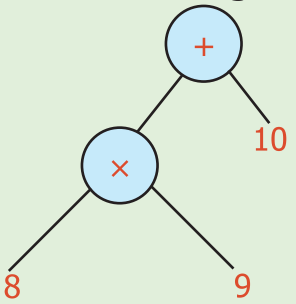
Example 12: Convert the Tree diagram into a numerical expression.

Tree diagram

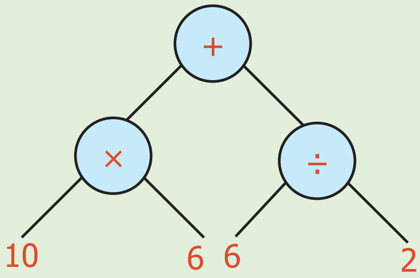


Numerical Expression

(8×9)+10

Example 13: Convert the Tree diagram into a numerical expression.

Tree diagram

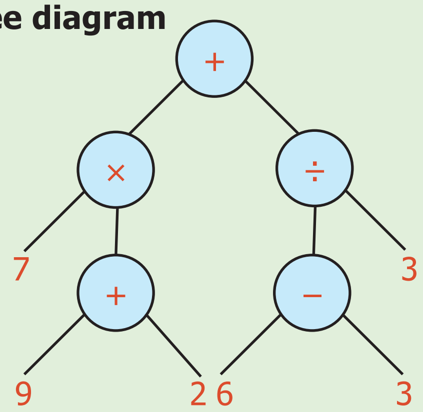


Numerical Expression

(10×6)+(6+2)

Example 14: Convert the Tree diagram into a numerical expression.

Tree diagram

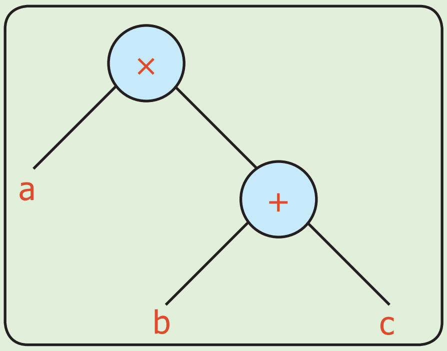


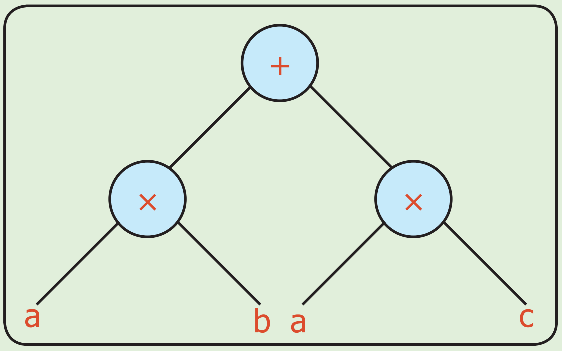
Numerical Expression

[7×(9+2)]+[(6–3)+3]

5.3 Conversion of Algebraic Expressions into Tree Diagrams

There is more fun with trees. Observe the following trees





The above tree is nothing but the familiar expression a×(b+c)=(a×b)+(a×c). Thus we can see the algebraic expressions as trees.

- The tree on the left has less number of nodes and looks simple.
- The tree on the right has more number of nodes
- Can we conclude that the value of both the trees are different?

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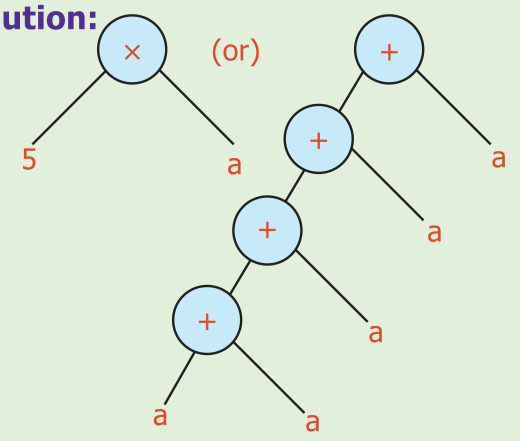
Example 15: Convert '5a' into Tree diagram.

Solution:

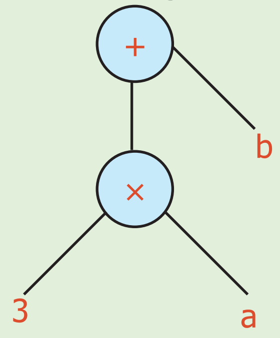


Example 16: Convert '3a+b' into Tree diagram.

Algebraic expression

3a+b

Tree diagram

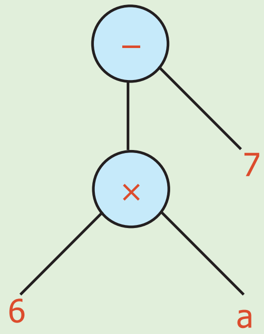


Example 17: '6 times a and 7 less '
Convert into a Tree diagram.

Algebraic expression

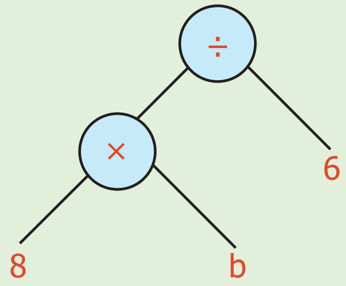
6a−7

Tree diagram



Example 18: Convert the tree diagram into an algebraic expression.

Tree diagram

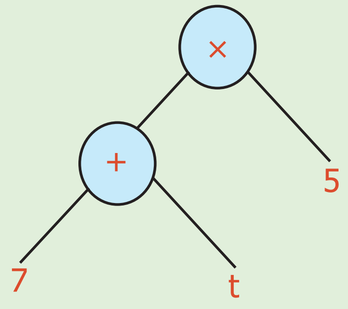


Algebraic expression

8b÷6

Example 19: Convert the tree diagram into an algebraic expression.

Tree diagram

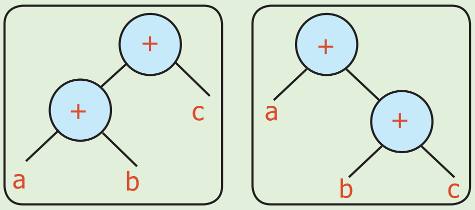


Algebraic expression

(7 + t)5

Example 20: Verify whether given trees are equal or not.

Tree diagram



(a+b)+c a+(b+c)

(a+b)+c=a+(b+c)

Yes, they are equal.

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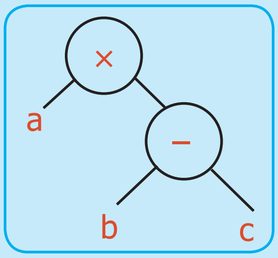
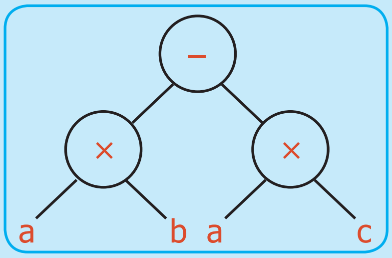
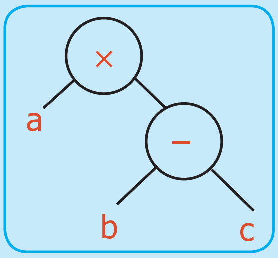
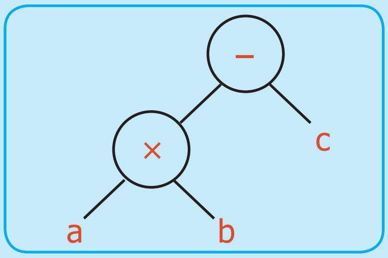
Try these

1. Convert the following tree diagrams into an algebraic expression.

i) 

and 

ii) 

and 

2. Convert the following algebraic expressions into a tree diagram.

i) (x−y)+z and x−(y+z)

ii) (p × q) × r and p × (q × r)

iii) a−(b−c) and (a−b)−c

DO YOU KNOW?

Consider the numerical expression 9 – 4. which means 4 is to be subtracted from 9. 9 – 4 can be represented as – 9 4 (so far we have come across with operation in between the operands)

Suppose the expression is 9 – 4 × 2. This can be represented as × – 9 4 2 gives the meaning of

Step 1: × 9 – 4 2

Step 2: (9 – 4) × 2

Take the expression + × – 9 4 2 5

Step 1: + × 9 – 4 2 5

Step 2: + (9 – 4) × 2 5

Step 3: [(9 – 4) × 2] + 5

This is reading an expression from "left to right". Similarly, we can read expressions from "right to left" also

9 4 2 5 + × – can be read as "right to left" expression which gives the meaning of

9 4 2 5 + × – => (9−4) 2 5 + ×

=> (9−4) × 2 5 +

=> [(9–4) × 2] + 5

Hence an expression can be read as "left to right" or "right to left" giving the same answer which is similar to name 4 as Naangu (நான்கு), Four, Nalagu (నాలుగు) and Char(चार), all of them representing the collection of four objects. Similarly the numerical expression

[(9 − 4) × 8] ÷ [(8 + 2) × 3] can be written as ÷ × – 9 4 8 × + 8 2 3 (left to right) or 8 9 4 – × 3 8 2 + × ÷ (right to left).

Try these: 1) × – + 9 7 8 2

2) ÷ × + 2 3 8 5

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Exercise 5.1

1. Convert the following numerical expressions into Tree diagrams.

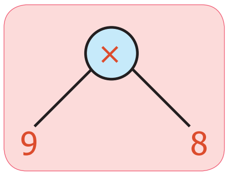
   (i) $8 + (6 \times 2)$ (ii) $9 - (2 \times 3)$

   (iii) $(3 \times 5) - (4 \div 2)$ (iv) $[(2 \times 4)+2] \times (8 \div 2)$

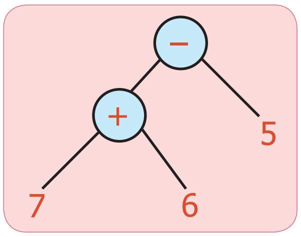
   (v) $[(6 +4) \times 7] \div [2 \times (10 -5)]$ (vi) $[(4 \times 3) \div 2] + [8 \times (5 - 3)]$

2. Convert the following Tree diagrams into numerical expressions.

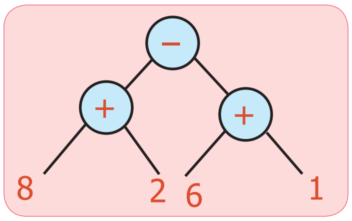
   (i)



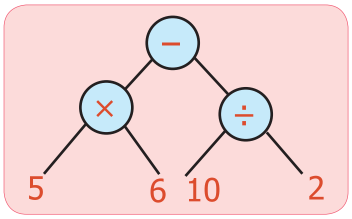
   (ii)



   (iii)



   (iv)



3. Convert the following algebraic expressions into tree diagrams.

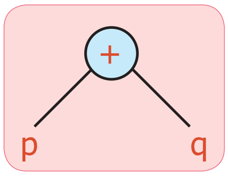
   (i) $10v$ (ii) $3a-b$ (iii) $5x+y$

   (iv) $20t \times p$ (v) $2(a+b)$ (vi) $(x \times y) - (y \times z)$

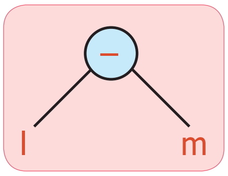
   (vii) $4x+5y$ (viii) $(lm-n)\div(pq+r)$

4. Convert Tree diagrams into Algebraic expressions.

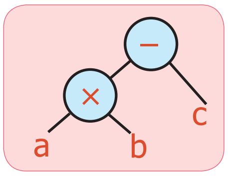
   (i)



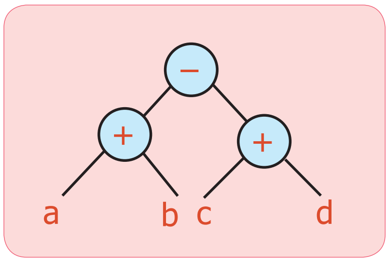
   (ii)



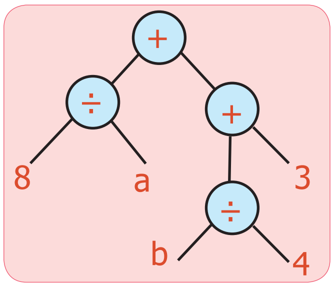
   (iii)



   (iv)



   (v)



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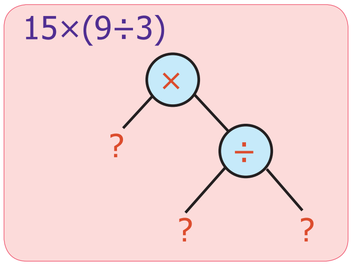
Exercise 5.2

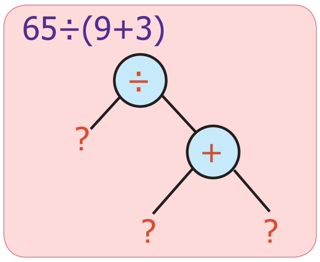
Miscellaneous practice problems

1. Write the missing numbers in the trees.

(i)



(ii)



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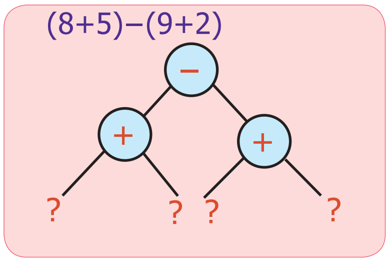
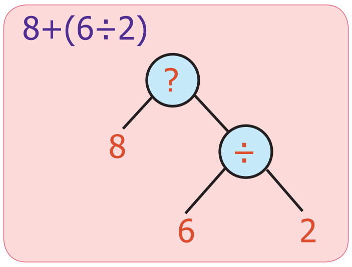
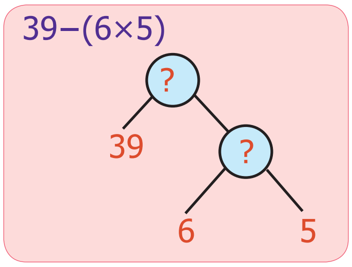


2. Write the missing operations in the trees.

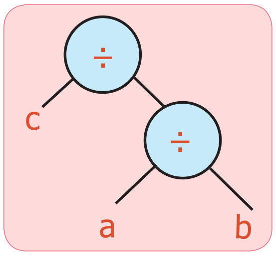
(i)



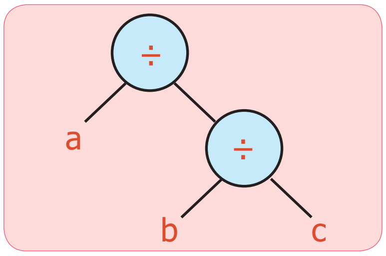
(ii)



3. Convert the following tree diagram into an algebraic expression.



and



Challenge problems

4. Convert the following questions into tree diagrams:
   (i) The number of people who visited a library in the last 5 months were 1210, 2100, 2550, 3160 and 3310. Draw the tree diagram of the total number of people who had used the library for the 5 months.
   (ii) Ram had a bank deposit of ₹ 7,55,250 and he had withdrawn ₹ 5,34,500 for educational purpose. Draw a tree diagram for this.
   (iii) In a cycle factory, 1,600 bicycles were manufactured on a day. Draw tree diagram to find the number of bicycles produced in 20 days.
   (iv) A company with 30 employees decided to distribute ₹ 90,000 as a special bonus equally among its employees. Draw tree diagram to show how much will each receive?
5. Write the numerical expression which gives the answer 10 and also convert into tree diagram.
6. Use brackets in appropriate place to the expression 3×8−5 which gives 19 and convert it into tree diagram for it.
7. A football team gains 3 and 4 points for successive 2 days and loses 5 points on the third day. Find the total points scored by the team and also represent this in tree diagram.

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ANSWERS

Chapter 1 Numbers

Exercise 1.1

1. i) 12 ii) 31 iii) 3 iv) 2 v) 10
2. i) False ii) False
   iii) True iv) True v) True
3. smallest → 11; biggest → 97
4. smallest → 100; biggest → 999
5. True. 3 + 7 + 9 = 19 is odd
6. (17, 71),(37,73) & (79,97)
7. False. 9 is odd number but not prime
8. True. The composite number 4 has 3 factors namely 1, 2, and 4.
9. 6, 12, 18, 24, 30 (excluding February)
10. 19
11. a) 60 = 2 x 2 x 3 x 5
    b) 128 = 2 x 2 x 2 x 2 x 2 x 2 x 2
    c) 144 = 2 x 2 x 2 x 2 x 3 x 3
    d) 198 = 2 x 3 x 3 x 11
    e) 420 = 2 x 2 x 3 x 5 x 7
    f) 999 = 3 x 3 x 3 x 37
12. (11, 13) or (13, 11)

Objective Type Questions

13. b) 2 14. c) 2 15. b) 92 16. c) 40
17. a) 80 18. d) impossible 19. a) 2
20. d) all of these

Exercise 1.2

1. i) 15 ii) 2
   iii) 3 iv) 156 v) 3
2. i) False ii) True
   iii)True iv) False v)True
3. i) 6 ii) 17
   iii) 1 iv) 12
   v) 9 vi) 5
4. i) 18 ii) 24
   iii) 30 iv) 42
   v) 120 vi)75
5. HCF → 22; LCM → 18018
6. HCF=20 litres
7. After 360 seconds (6 min), at 8.06 a.m
8. 2 pairs possible
9. 24

Objective Type Questions

10. c) 71, 81 11. d) 9936
12. b) 36 13. c) 80

Exercise 1.3

1. 4 = 2 + 2; 6 = 3 + 3; 8 = 3 + 5;
   10 = 3 + 7 (or) 5 + 5; 12 = 5 + 7;
   14 = 7 + 7 (or) 3 + 11;
   16 = 5 + 11 (or) 3 + 13
2. Yes, because it has only two factors.
3. For n = 2, 3, 4, 6 and 7
4. a) False, 3 is a factor of 9
   b) True, 12 is a multiple of 6
5. i) 8 ii) 0 iii) 9 iv) 1 v) 8
6. False. 12 is divisible by both 4 and 6 but not by 24
7. True. 17+19=36 is divisible by 4
8. 40 cm

Challenge problems

9. 2, 37, 41
10. 11, 13, 17, 19; The sum 60 is divisible by 1, 2, 3, 4, 5 and 6 but not divisible by 7, 8 and 9
11. 2520
12. Yes. 2 x 3 x 4=24 is divisible by 6.
13. Once in 30 days, 31st October
14. The lifts will stop at floors 15, 30, 45, 60, 75, 90 and 105
15. (15, 20)
16. Yes. Since it is divisible by both 8 and 11 and hence by 88
17. After 60 minutes, at 8 a.m

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Chapter 2 Measurements

Exercise : 2.1

1. i. 3/4 *l* ii. 205 *kg* 950 *g* iii. 18 *l* 500 *ml*
   iv. 2 *l* 250 *ml* v. 500
2. i. True ii. False iii. True
   iv. True v. False
3. i. 10005 *ml* ii. 4300 *m* iii. 0.3 *g*
4. (i) 1300 *cm*, 13 *m*, 0.013 *km*
   (ii) 8.257 *l*, 0.008257 *kl*
5. i) 15000 *m*, 1500000 *cm*, 15000000 *mm*
   ii) 12000 *g*, 12000000 *mg*
6. i) < ii) = iii) = iv) < v) >
7. 1 *l* 950 *ml*
8. 155 *cm*
9. 50 *kg* 500 *g*
10. Maran ,100 *m*
11. 6 *kg*, 0.6 *l*
12. 800 students
13. i. 20 glasses ii. 40 glasses
    iii. 4 glasses iv. 2 glasses
    v.8 glasses

Objective Type Questions

14. (b) 904 *cg* 15. (a)1 *kg* 6 *g*
16. (d)1050 *l* 17. (d)70 *mg*
18. (b) 2 *km* 800 *m*

Exercise : 2.2

1. i) 10:15 hours; quarter past 10
   ii) 6:45 hours ; quarter to 7
   iii) 4:10 hours ; 10 minutes past 4
   iv) 3:30 hours; half past 3
   v) 9:40 hours; 20 minutes to 10;
2. i. (d) ii. (e) iii. (b) iv. (c) v. (a)
3. i) 1200 seconds ii) 20140 seconds
   iii) 210 minutes iv) 9 hours 40 minutes
   v) 7 hours
4. 11 hours 5 minutes 25 seconds
5. 1 hour 58 minutes 5 seconds
6. i) 2 a.m ii) 8:45 a.m
   iii) 9:10 p.m iv)11:20 a.m
   v) 12 midnight
7. i) 3:15 hours ii) 12:35 hours
   iii) 12:00 hours iv) 00:00 or 24:00 hours
8. i) 7 hours 10 minutes
   ii) 8 hours 55 minutes
   iii) 8 hours
   iv) 12 hours 15 minutes
9. i) 13:40 hours , 21:20 hours
   ii) 8 halts iii) 5 minutes
   iv) 20:34 hours
   v)7 hours 40 minutes
10. 285 days 11. 7 hour 42 minutes
12. 172 days 13. Friday
14. (i) 1 year 3 months 25 days
    (ii) 3 years 2 months

Objective Type Questions

16. (b) 48 17. (a) 21
18. (d) 3 19. (b) 3:35 hours 20. (b) 30

Exercise : 2.3

1. 14 m 78 cm 2. 2000; 560
6. i) Yes
7. 40 hours 30 minutes
9. She will not catch the train

Chapter 3 Bill, Profit and Loss

Exercise 3.1

1. i) Mullai Furniture mart iv) 50 sets
   ii) Serial No: 728 v) correct
   iii) ₹3000
2.

Cash Bill				
Maruthu Book Store, Chidambaram				
Bill No.570			Date : 12.04.2018	
Sl. No.	Item	Quantity	Rate	Amount
1.	Subramanya Bharathiyar	10	55	550
2.	Thiruvalluvar	15	75	1125
3.	Veeramamunivar	12	60	720
4.	Thiru.Vi.Ka	12	70	840
Total				3235

3. i) Profit = ₹20 ii) Profit = ₹10
   iii) S.P. = ₹140 iv) Loss = ₹10
   v) S.P. = ₹145
4. i) S.P. = ₹130 Profit = ₹20
   ii) S.P. = ₹120 Profit = ₹10
   iii) S.P. = ₹100 Loss = ₹10
   iv) S.P. = ₹90 Discount = ₹30
   v) S.P. = ₹110 C.P. = ₹90

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5. Profit = ₹15
6. Loss = ₹40
7. No Profit / Loss
8. S.P. = ₹8,75,000
9. C.P. = ₹25,000
10. Discount = ₹295
11. M.P. = ₹1850
12. Discount = ₹25
13. S.P = ₹3
14. Loss = ₹5585

Objective Type Questions

15. (a) M.P.
16. (b) C.P
17. (a) C.P = S.P
18. (b) S.P

Exercise 3.2

1. Gain = ₹15
2. Loss = ₹50
3. Profit = ₹200
4. Profit =₹1,00,000
5. Gain = ₹32
6. M.P. = ₹29
7. Profit =₹960
8. Profit = ₹3000

Chapter 4 Geometry

Exercise 4.1

1. a) two b) scalene triangle c) two
   d) 180° e) isosceles right angled triangle
2. i) Scalene triangle
   ii) Right angled triangle
   iii) Obtuse angled triangle
   iv) Isosceles triangle
   v) Equilateral triangle
3. a) $\overline{AB}, \overline{BC}, \overline{CA}$
   b) $\angle ABC, \angle BCA, \angle CAB$ or $\angle A, \angle B, \angle C$
   c) A, B, C
4. i) Equilateral triangle ii) Scalene triangle
   iii) Isosceles triangle iv) Scalene triangle
5. i) Acute angled triangle
   ii) Right angled triangle
   iii) Obtuse angled triangle
   iv) Acute angled triangle
6. i) a) Isosceles Acute angled triangle
   ii) a) Scalene Right -angled triangle
   iii) a) Isosceles Obtuse angled triangle
   iv) a) Isosceles Right -angled triangle
   v) a) Equilateral Acute angled triangle
   vi) a) Scalene Obtuse angled triangle
7. i) Yes, Scalene triangle
   ii) Yes, Scalene triangle
   iii) No, The triangle cannot be formed
   iv) Yes, Isosceles triangle
   v) Yes, Equilateral triangle
   vi) No, The triangle cannot be formed
8. i) Yes, Acute angled triangle
   ii) Yes, Right angled triangle
   iii) No, The triangle cannot be formed
   iv) No, The triangle cannot be formed
   v) Yes, Acute angled triangle
   vi) Yes, Obtuse angled triangle
9. i) 40° ii) 70° iii) 60°
   iv) 40° v) 30° vi) 40°
10. Equilateral Triangle
11. ii) Acute angled triangle, Isosceles triangle
    iii) Right angled triangle, Isosceles triangle
    iv) Acute angled triangle, Scalene triangle
    v) Acute angled triangle, Scalene triangle
    vi) Right angled triangle, Scalene triangle
    vii) Obtuse angled triangle, Scalene triangle
    viii) Obtuse angled triangle, Isosceles triangle

Objective Type Questions

12. b 13. d 14. a 15. d 16. c

Exercise 4.3

1. 90°, 45° , 45°
2. c
3. c
4. 28°, 28°
5. Both are Isosceles Right angled triangles
6. Yes
7. No, A triangle cannot have more than one right angle
8. "a" is true, because an isosceles triangle need not have three equal sides
9. 70°,40° or 55°,55°
10. c
11. a) ΔABC b) ΔABC , ΔAEF
    c) ΔAEB, ΔAED, ΔADF, ΔAFC, ΔABD, ΔADC, ΔABF, ΔAEC
    d) ΔABC, ΔAEF, ΔABF, ΔAEC
    e) ΔAEB, ΔAFC
    f) ΔADB, ΔADC, ΔADE, ΔADF
12. (i) between 3 and 11 (iii) between 4 and 11
    (ii) between 0 and 16 (iv) between 4 and 24
13. i. Always acute angles ii. Acute angle
    iii. Obtuse angle

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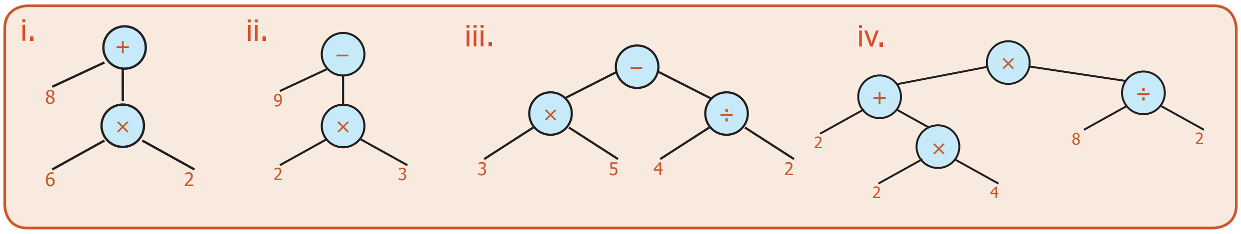
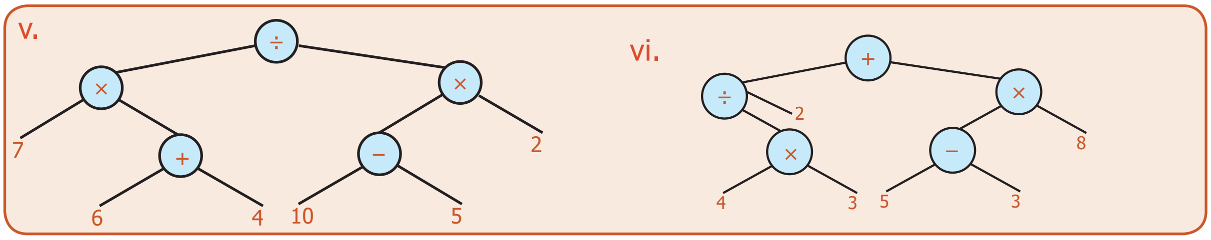
Chapter 5 Information Processing

Exercise 5.1

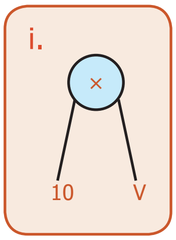
1)

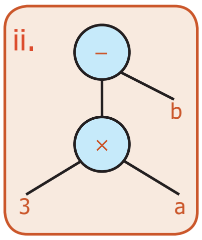


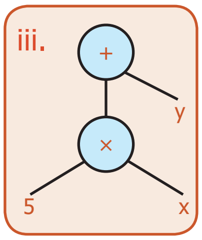


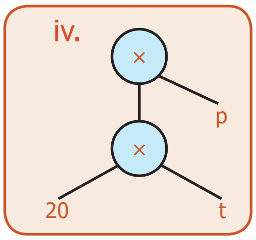
2) i. 9×8 ii. (7+6)−5 iii. (8+2)−(6+1) iv. (5×6)−(10÷2)

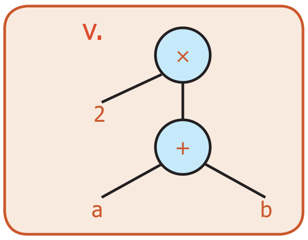
3)

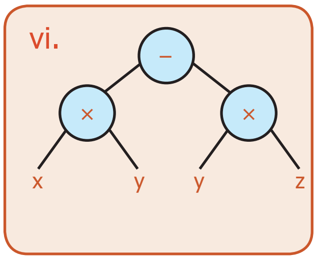


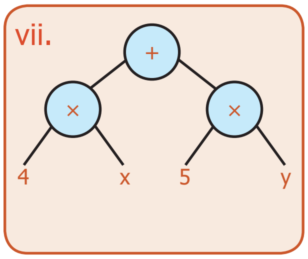


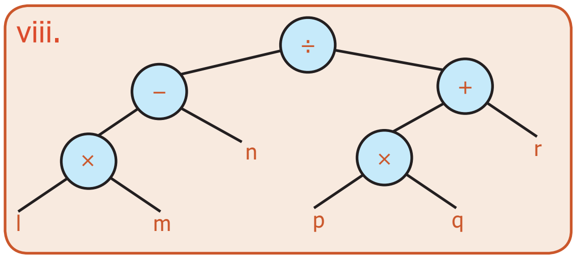








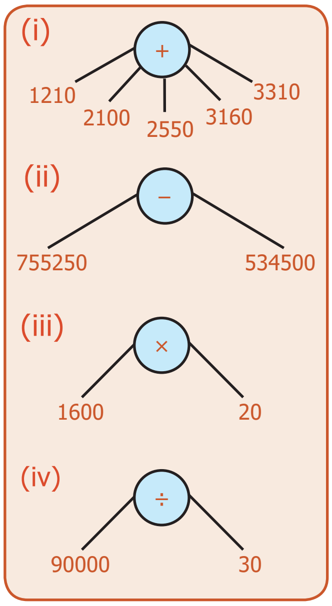




4) Algebraic expression

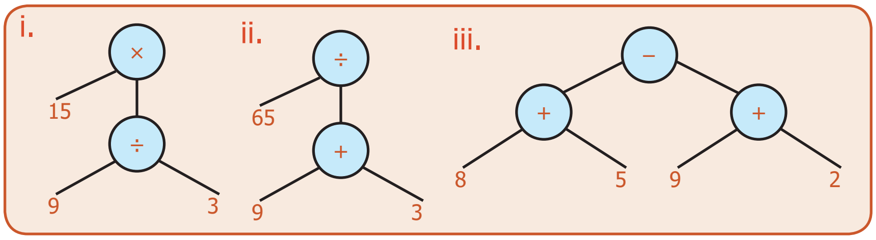
(i) p+q	(ii) l−m	(iii) ab−c	(iv) (a+b)−(c+d)	(v) (8÷a)+[(b÷4) + 3]

4)

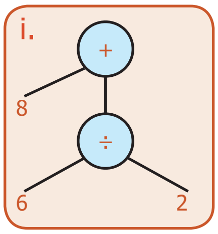


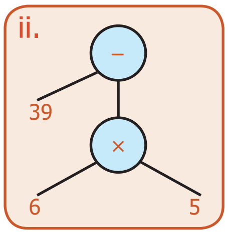
Exercise 5.2

1)

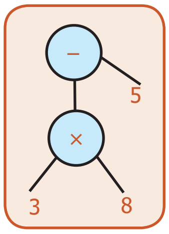


2)

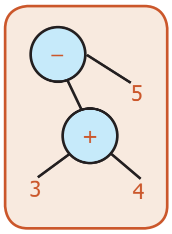




6) (3×8)−5=19



7)



3) Not equal

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MATHEMATICAL TERMS

Acute angled triangle	குறுங்கோண முக்கோணம்	Measurement	அளவைகள்
Algebraic expression	இயற்கணித கோவை	Metric units	மெட்ரிக் அளவைகள்
Amicable numbers	இணக்கமான எண்கள் / நட்பு எண்கள்	Midnight	நள்ளிரவு
Angles	கோணங்கள்	Millennium	ஆயிரம் ஆண்டுகள்
Antemeridian	முற்பகல்	Minute hand	நிமிட முள்
Arrival time	வந்து சேரும் நேரம்	Multiple	மடங்கு
Astronomical units	வானவியல் அலகு	Node	கணு
Atomic clock	அணு கடிகாரம்	Numerical expression	எண்கணித கோவை
Bill	பட்டியல்	Obtuse angled triangle	விரிகோண முக்கோணம்
Bottom	கீழ்பாகம்	Odd number	ஒற்றை எண்
Branches	கிளைகள்	Ordinary time	சாதாரண நேரம்
Candle clock	மெழுகுவர்த்தி கடிகாரம்	Parallel lines	இணை கோடுகள்
Capacity	கொள்ளளவு	Pendulum clock	ஊசல் கடிகாரம்
Century	நூற்றாண்டு	Perfect Number	செவ்விய எண் / நிறைவு எண்
Composite number	பகு எண்	Perpendicular lines	செங்குத்துக் கோடுகள்
Co-prime numbers	சார் பகா எண்கள்	Postmeridian	பிற்பகல்
Cost price	அடக்க விலை	Prime number	பகா எண்
Cubit	முழம்	Profit	லாபம்
Dealer	முகவர்	Quartz clock	குவார்ட்ஸ் கடிகாரம்
Departure time	புறப்படும் நேரம்	Railway time	இரயில்வே நேரம்
Digital clock	இலக்க முறை கடிகாரம்	Revolves	சுற்றி வருவது
Discount	தள்ளுபடி	Right angled triangle	செங்கோண முக்கோணம்
Duration	நேர இடைவெளி	Rotate	தன்னைத் தானே சுற்றுவது
Edge	விளிம்பு	Sand clock	மணற் கடிகாரம்
Equilateral triangle	சமபக்க முக்கோணம்	Standard Units	திட்ட அலகுகள்
Even number	இரட்டை எண்	Scalene triangle	அசமபக்க முக்கோணம்
Factor	காரணி	Seconds hand	நொடிமுள்
Foot	அடி	Selling price	விற்ற விலை
Higher units	மேலின அலகுகள்	Set square	முக்கோணமானி / மூலை மட்டம்
Highest Common Factor	மீப்பெரு பொது காரணி	Shopkeeper	கடைக்காரர்
Horology	காலங்காட்டிகளை பற்றிய படிப்பு	Side	பக்கம்
Hour hand	மணி முள்	Span	சாண்
Isosceles triangle	இருசமபக்க முக்கோணம்	Standardised measure	திட்ட அளவைகள்
Leap year	லீப் ஆண்டு / நெட்டாண்டு	Tree diagram	மரவுரு படம் / மரச் செடி வரைபடம்
Least Common Multiple	மீச்சிறு பொது மடங்கு	Triangle	முக்கோணம்
Light year	ஒளியாண்டு	Triangle Inequality	முக்கோண சமனின்மை
Line segment	கோட்டுத்துண்டு	Triplet	மூன்றன் தொகுதி
Loss	நட்டம்	Twin primes	இரட்டை பகா எண்கள்
Lower units	கீழின அலகுகள்	Vacuum	வெற்றிடம்
Manufacturer	உற்பத்தியாளர்	Vertex	உச்சி / முனை
Marked price	குறித்த விலை	Volume	கனஅளவு
Maximum retail price	அதிகபட்ச விற்பனை விலை	Water clock	நீர் கடிகாரம்

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CLASS- 6
MATHEMATICS – TERM – II
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